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SIGNS FOR THE CITY TRAVELLER

By

LCDR. Russell P. Nystedt, CEC, USN

PRINCETON UNIVERSITY

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Developing a Broader and More Useful System of

Traffic Signs for Use in Cities

SIGNS FOR THE CITY TRAVELLER

By

LCDR. Russell P. Nystedt, CEC, USN

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science in Engineering

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PREFACE

The existence of New York City is probably as much a reason for this study as is any other single factor. Coupled with its proximity to Princeton, it has offered a source for academic education and personal interests too good to overlook during this past year. But it was an offer which demanded trips to and through the streets of that city either as a driver, a subway or bus rider, or a pedestrian. It also required the use of signs which were posted to regulate, inform and direct the users of each of these forms of transportation. Unfortunately, good directions and useful information were often found to be lacking.

New York is not unique in this respect. There are few, if any, cities where a stranger can effectively find his way. The reasons are in many cases correctable by simply improving the form and availability of the signs posted for use. This study shows how some of these improvements can be obtained.

The author wishes to thank especially the following who have contributed so much toward not only the successful completion of this thesis but the year of study it culminates:

The Bureau of Yards and Docks, Department of the Navy, for making this period possible.

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CHAPTER I

INTRODUCTION

Signs can be extremely effective devices. They function to inform, direct, locate, or promote using only the features of color, shape and legend. At the same time, they can vary in size within broad limits for use in untold locations and situations.

This study analyzes signs in their functions as informers and directors in a very complex and increasingly common environment--the city.

Whether moving on foot, in a car, or on some form of public transportation, signs are the commonest means of regulating movement, warning of dangers, and guiding individuals incident to their arrival at a destination. Despite this fact, sign systems marking the routes of pedestrians and riders today in most cities fail to meet the full needs of their users. They have proven to be inadequate, poorly designed and totally unrelated to each other.

The intent of this study is to propose both new signs and system of signing which will solve this problem.

In order to familiarize the reader with terms that are used throughout this work, several definitions or explanations are presented before proceeding any further:

> A "sign," as the term is commonly used in the field of traffic engineering, is a simple non-electrical device which is designed to display permanent facts of information. Traffic lights, for example, are not signs; they are signals. This study will concentrate on signs only.

"Traffic" refers to all forms of traffic--the automobile driver, the pedestrian, and the mass transit rider. It is commonly thought to apply almost completely to street traffic, but in this study it will be used in its true and broader sense.

A "system of signs" is the physical location of the signs posted in any city or part of a city, such as on a bus line or subway route.

The Manual on Uniform Traffic Control Devices for Streets and Highways is a publication of the Department of Commerce, Bureau of Public Roads, which specifies standards for streets and highways in the United States. Although its use is not mandatory, it has been widely accepted by all states and made compulsory by law in most. Due to its long title and continued use throughout this study, it will commonly be referred to as "the Manual."

Despite the harsh statements made about the poorly designed and inadequate sign systems found in most cities, a great deal of work has been done in the United States and elsewhere[1] to develop and improve standard sign systems for use on streets and highways. One of the earliest U. S. efforts to institute a uniform standard for national use

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[1]The United Nations "Protocol on Road Signs and Signals" issued by the United Nations Conference on Road and Motor Transport, September 19, 1949. "Final Report Submitted by the Group of Experts on Road Signs and Signals," 22 July 1952 (E/CN.2/119).

occurred when the American Association of State Highway Officials (AASHO) published a manual for rural highways in 1927. Since that date other organizations[2] have joined with the AASHO to form the National Joint Committee on Uniform Traffic Control Devices which periodically reviews the standards established. Their latest manual[3] was published in 1961 by the U. S. Department of Commerce. Although intended to have the widest practical use possible, it is less applicable to urban than to rural situations due to the complexity of city traffic problems. The shortcomings, however, are minor in comparison with the value that the standards produce in the over-all efficiency and safety of motor vehicle operations.

In direct contrast to research and progress on street and highway signing, little has been done to analyze the needs of a standard pedestrian sign system. In spite of rapid technological advances, door to door transportation by private auto, or any other conveyance, is far from a reality. Walking is still an important mode of travel, particularly in our congested cities.

It seems strange, and yet somewhat of a tribute, that in spite of the intensity of pedestrian traffic found in downtown areas, the street

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[2]Other members of the National JointCommittee on Uniform Traffic Control Devices include the Institute of Traffic Engineers, National Committee on Uniform Traffic Laws and Ordinances, National Association of County Officials and the American Municipal Association.

[3]U. S. Dept. of Commerce, Bureau of Public Roads, Manual on Uniform Traffic Control Devices for Streets and Highways, Washington: U. S. Government Printing Office, 1961.

name sign continues to be the primary and perhaps only directional device used regularly by the foot passenger. It is lamentable, however, that most cities have failed to take full advantage of even this simple device. Information placed on it is usually the minimum acceptable, i.e. name of street, leaving off cross street and block numbers and in so doing providing the prospective user with a mute landmark rather than an active guide. The contention that the pedestrian has not been forgotten, in the way of adequate signing, seems to apply only to the safety aspects of travel, such as crosswalk and safety island designations, rather than directional or guide signs.

Mute Active

Fig. 1. The street name sign. A mute landmark or an active guide?

The third mode of transportation, mass transit, presents a most unique situation as regards signs. In spite of the lack of a standard, there is certainly no want of ideas in the industry. It seems that bus, subway and train stations in every city solve the problem of "effective" signing in a different way. The problem here is not the lack of an informational system but the need for a uniform high standard to insure maximum usefulness to the user.

Why change or standardize signs in a city? Residents can usually travel confidently by foot or automobile with only an occasional glance

at signs, just enough to know where to catch the bus, get off the subway or make a correct turn. They know where to look and what to look for because the route and surroundings are familiar. Obviously, the same is not true for a stranger. He is dependent on all the information that signs can give. And a stranger in cities is not uncommon today. Besides the out-of-town and foreign visitors, many dwellers in large cities are not even able to travel within their own metropolitan areas without fear of getting lost. Urban areas are growing and travel is continuously becoming more essential to business and pleasure. All the evidence adds up to more travel and more strangers. A familiar sign, a sign that can be easily recognized and be depended on to provide information, will be an invaluable aid to speed the stranger on his way.

It appears, though, that each of the three forms of travel discussed is faced with unique, yet necessarily related, sign problems. The development and increased use of the automobile has necessitated the construction of elaborate, involved, difficult-to-sign roadways. The pedestrian has been left largely to his own wits, using the street sign, borrowing information posted for the automobile driver and using conspicuous landmarks. And the mass transit rider has had to contend with a collection of names, numbers, arrows and confusing code systems that are sometimes misunderstood and often ignored due to the inconsistency of their use.[4] Any traveller could easily be required to use all three of

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[4]One transit corporation operating both subway and bus facilities in a large American city uses color to differentiate local and express service. Underground, red specifies express and green local service. On the surface, the meaning of the colors is just reversed.

those forms of transportation and therefore be dependent on each of their sign systems. Why should they be so dissimilar? Why can't each resemble and support the other and thereby reinforce the usefulness of all?

The chapters that follow attempt to answer these questions by the use of two values. First, an analysis of the principles and features of signs, and second, a presentation of examples of sign systems that have proven effective in providing information to their users.

Several interesting questions are raised in the course of the evaluations. How much effective use can be made of the psychological characteristics of color, shape and legend--the three primary features of signs? To what extent do the principles of advertising apply to the principles and design of traffic signs? Have local conditions allowed a sign system to function effectively without really being universally adaptable?

Answers to these questions provide only a few of the factors taken into consideration in studying this subject. The results and recommendations will attest to that. But a conclusion cannot be reached without a beginning, and the next chapter provides that start--a review of the principles and problems of signing.

CHAPTER II

PRINCIPLES AND PROBLEMS OF SIGNING

Any sign used to provide a user with information or to regulate his movement should meet five elementary requirements:[1]

1. It should be capable of filling an important need.
2. It should command attention.
3. It should convey a clear, simple meaning.
4. It should command respect.
5. It should be located to give adequate time for response.

Filling an Important Need. Perhaps one of the severest criticisms of the suggestion to broaden the scope of the uniform traffic signing is the apparent lack of attention given to the existing standardization. To fill an important need, something must be lacking. Since too few people pay attention to what is already existing, how can increased uniformity be useful? The answer may lie in the very narrowness of current standardization.

Only a small part of the day is spent on the highways by most automobile drivers,[2] where a considerable amount of uniformity in traffic control now exists. If both pedestrian and public transportation signs resembled the existing color, shape and legend of street and highway signs serving similar functions, or if some more refined system were adopted for all three, wouldn't each reinforce the meaning of the other? If the answer is yes,

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[1] U. S. Dept. of Commerce, p. 2.

[2] The urban resident uses his car to travel about ten miles each day in all pursuits. Wilbur Smith and Associates, Future Highways and Urban Growth (New Haven: Author, 1961), p. iv.

then not only would a broader uniformity fill an important need, it would also increase the usefulness of traffic control devices now in existence. Regardless of the answer, as it related to all three areas of transportation, at least two types of users, the pedestrian and mass transit rider, are continuously faced with inconsistent or meager information. The need for improvement is obvious.

Attention and Meaning. The necessity for signs to command attention and convey clear, simple meaning are mandatory in any good communications system. Traffic signs in the city must convey information to the observer just as well as commercial signs or be completely ineffective. The attention necessary to do the job is generally obtained through the use of good position, size, color, intensity, contrast, or interest devices.

Since traffic signs must compete with commercial advertising, the principles used in that industry should provide some help in understanding and meeting the competition. The ability to convey clear, simple meaning is described in one advertising textbook as follows:[3]

> "The message may 'tie in' so well with the thoughts of the reader. . .that it becomes a part of the context; or. . .may seem so attractive or dominating that other activities are abandoned in order to attend to it."

In other words, the prospective customer either wants to be sold, because of a need, or is so impressed by the message that he is sold.

Transportation signs also fall into one or the other of these two categories. Directional and information messages usually "tie in" with

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[3]Albert Wesley Frey, Advertising (2nd ed., New York: The Ronald Press Company, 1953), 456.

the needs of users since they provide a sought after service. The other two classes of signs,[4] regulatory and warning, are more nearly like the second category where the message must be impressed on the user through some dominating characteristic. The fact that they are there to protect the public does not seem to alter this situation. For this reason, the position of regulatory and warning signs take precedence over guide signs.

The situations faced by signs in each of the three modes of transportation are different in several important respects. Foremost is the contrast in environment between public roads and the interior of buildings or stations. Outdoors, particularly in city centers, public and private signs continuously fight for recognition. Due to the variety of methods available and used by commercial sign manufacturers, in which no pretense is made about the attempt to overpower every other display in the vicinity, the public sign is handicapped. An interesting study was recently completed by graduate students of the Department of City and Regional Planning at M.I.T.[5] in which private signs are discussed and dealt with in several ways, each clarifying and simplifying commercial devices and thereby reducing clutter. The recommendations aim at stricter municipal control of sign standards (Fig. 2).

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[4]Functionally U. S. Highway signs are classified as regulatory (provide notice of laws or regulations), warning (call attention to potentially hazardous traffic operations), and guide signs (show destinations, directions, provide information); U. S. Dept. of Commerce, p. 10.

[5]Massachusetts Institute of Technology, Signs in the City (Cambridge, June 1963).

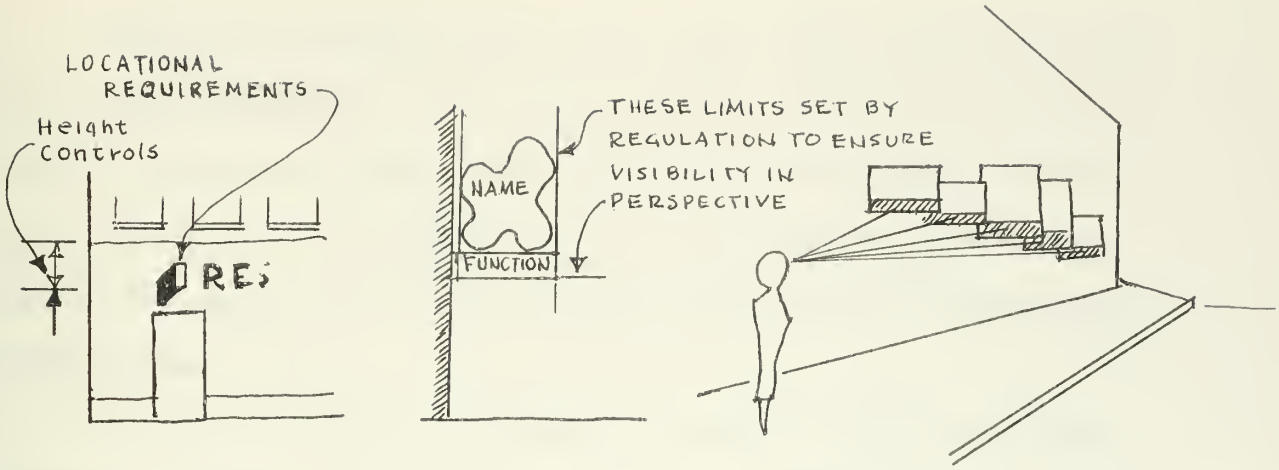

Fig. 2. Examples of Municipal Control of Sign Standards. (Source: Signs in the City, Massachusetts Institute of Technology, Cambridge, June 1963).

Better results could be obtained, even without additional regulation, by raising the standards of design on existing public signs and finding more effective devices or displays to impress the observer. Ideally, this would be done through no increase in the square foot area of signs now posted. A start might come through the use of the backsides of the many surfaces now in existence.

Secondly, since the city is filled with so many vertical signs posted from five to ten feet above the surface, additional use of horizontal markings placed directly on road surfaces appear not only practical but essential. The pavement is in the normal field of vision of the driver and allows him to view signs without taking his eyes off the roadway. There are limitations to this proposal, including the possibility that rain, snow, or wear might obliterate the markings to some degree. But improvements in the characteristics of material now available for highway markings can probably negate the first and last problem. Just snow, although only a temporary problem, would prove to be a major handicap.

Similar and different difficulties might occur in the use of pavement markings for outdoor foot passenger travel. Pedestrian movement is not as closely tied to the ground surface as is the automobile driver's, and if the visibility problems caused by a surrounding crowd are considered, the general use of sidewalk signs seems much more limited than roadway signs.

The use of intensity, contrast and interest devices to attract attention all have a more limited application in traffic signing than is found in commercial advertisement. The necessity for long term nature of public signs makes it essential that any unusual attention getter used have indefinite appeal.

Intensity of light used to illuminate signs affects the amount of attention attracted. But it must be kept in mind that the interest lags behind the increase in intensity.

Contrast may take one or more of several forms. Using color, for instance, even though black on white, affords great contrast, but its attention value is slight because it is so common. The reverse situation, on the other hand, attracts attention because it is unusual. Other contrasts which might be adapted to use include size difference and complementary colors. These two points will be discussed in more detail in later chapters.

The use of interest devices in traffic signing relates less to the physical appearance of individual signs than to the attention they bring to the entire system. They would provide the publicity necessary to promote the use of any standardization. This, then, is a reminder that despite the role that traffic signs play as public servants their meaning

and presence must be advertised widely to insure that they do the job they are capable of doing. If broader standardization of traffic signing were adopted, a major publicity campaign would be essential to promote its early and effective use.

Command Respect. Respect for signs consists of more than the element of legal compliance. Uniformity, reasonableness, size, and legibility are also important components. Just as routine procedure soon becomes an unconscious response to past thinking, a standard sign message will increase the conformity of use through continuous contact. This need for consistency of appearance does not necessarily apply to all worded messages. In regulatory control it is nearly always essential since regulations are, by their nature, standardized. But in information signs, many different facts are conveyed and it would seem impossible to develop some form of abbreviated symbology to describe all the messages that should be displayed in a busy city. Similarly, standardization of the form or style of lettering on public signs, again with the exception of regulations and warnings, is not esthetically desirable or essential. Letters can suit the characteristics of location plus architecture and still remain standard. The solution to problems discovered as a result of this approach, as suggested by one authority, is teamwork among architects, town planners, designers and municipal authorities.[6]

Even on the standardized highway signs, this teamwork should not be overlooked. A solution of any conflict of interest brought up as a result of esthetic versus practical considerations would appear to be for

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[6]Willy Rotzler, "Public Signs and Lettering," Graphis, 18:582-609, November 1962.

the scientist and engineer to state their minimum requirements governing sign design and to ask the designer for the most economical design within these limitations.[7]

Reasonable sign design takes into account the ability of the user to understand as well as comply with the message displayed.

Fig. 3. An Unreasonable Traffic Sign.

Figure 3 shows a sign which lacks reasonableness simply because of its demands. No driver could be expected to comply with the exactness called for, so the words are shrugged off as more of a joke than a requirements.

In a different way, the elaborate color code system of the Metropolitan Toronto buses lacks reasonableness. The route and destination signs displayed for public use on the conveyances are identified as follows:

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[7]R. L. Moore and A. W. Christie, "Research on Traffic Signs," Engineering for Traffic Conference, July 1963, p. 113.

Route Names:	White Letters on Black
Destinations:	White Letters on Red
Express Sign:	Black Letters on Yellow
Route Numbers:	Black Figures on Yellow
Exhibition:	White on Red
Charter:	White on Royal Blue
Special:	Red on White
Races:	White on Middle Green
Garage:	White on Black

The effectiveness of the system is lost in this example through the elaborate steps taken to inform the waiting passenger.

It is unlikely that many people know or remember the meaning of all the color combinations shown above. It is even less likely that they care what use a bus is being put to if it is not theirs.

By keeping the use and meaning of signs confined to essentials, a much more reasonable and effective system could have resulted.

Signs of adequate size and legibility are essential in promoting the respect necessary for a useful traffic control system. The size of signs must depend primarily on the length of its message and the size and spacing of letters or symbols on it. At the same time, where sign size is limited, the design of letters or symbols must be modified to insure maximum legibility under the existing conditions.

Since sign needs differ greatly for motorists, moving at high speeds, than for the pedestrian, time-distance factors should be the primary basis for determining letter size (Fig. 4).

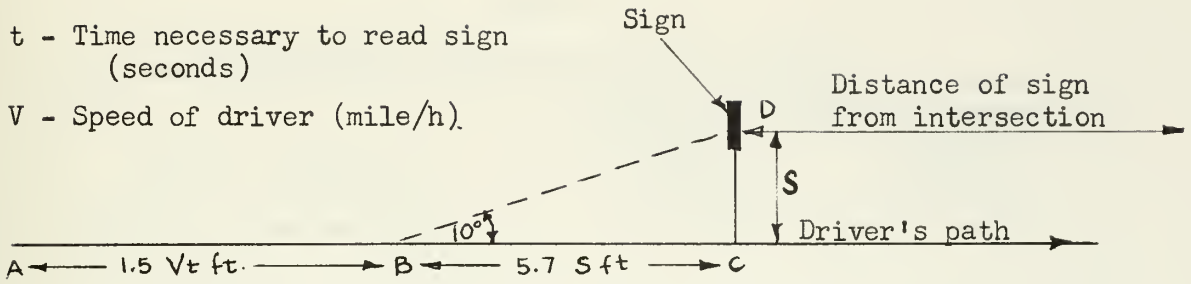

Fig. 4. Calculation of Letter Size for Advance Direction Signs. The driver should finish reading the sign before reaching B. He must therefore be able to start reading at A. (Source: R. L. Moore and A. W. Christie, "Research on Traffic Signs," Engineering for Traffic Conference, July 1963, p.113.)

Design standards covering dimensions, wording and lettering for street and highway signs and markings are found in the Manual and are available through the Bureau of Public Roads, Washington, D. C., or can be found in various textbooks and publications.[8]

The determination of letter size for the interior of buildings, although not found in any national standard, are still available from a variety of sources. Since speed is a much less important consideration, sizes are based on distance plus illumination and type of messages involved.

Table 1 shows recommendations found in Human Engineering Guide to Equipment Design.[9] Although intended for determining the size of markings for short distance viewing (28"), the factors are also applicable for greater distances.

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[8]See Theodore M. Matson, Wilbur S. Smith and Frederick W. Hurd, Traffic Engineering (McGraw-Hill Book Company, New York, 1955); Moore and Christie, "Research on Traffic Signs"; also for continuing developments see R. W. Crum, Fred Burggraf, W. N. Carey (ed.), Highway Research Board, Washington, D. C.

[9]Clifford T. Morgan, et al. (editors), Human Engineering Guide to Equipment Design. Sponsored by Joint Army-Navy-Air Force Steering Committee (New York: McGraw-Hill Publishing Company, Inc.), Table 2-11, p. 103.

TABLE 1

Recommended Numeral and Letter Heights*

Nature of Markings	Height of Letters in Inches	
	Low** Brightness	High*** Brightness
Emergency Instructions	0.15-0.30	0.10-0.20
Identification or Routine Instructions	0.05-0.20	0.05-0.20

*For 28" viewing distance. For longer distances increase values proportionately.

**Between 0.03 and 1.0 Ft-L.

***Above 1.0 Ft-L.

Adequate Response Time. Proper placement of signs is even more essential to effective communications than is good design. Quoting from page 2 of the Manual,

> "Placement of the device must assure that it is within the cone of vision[10] of the normal user so that it will command attention; that it is positioned with respect to the point, object or situation to which it applies to aid in conveying the proper meaning; and that its location, combined with suitable legibility, is such that a driver traveling at normal speed has adequate time to make the proper response."

The decision to use a sign for automobile traffic control is properly determined by an engineering study of the location under consideration.[11]

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[10]When an eye is fixed in position, the area of most acute vision is subtended by a cone whose angle is 3 degrees. To be accurately identified, words and symbols on traffic signs must fall within a visual cone of 10 degrees. This is roughly the area covered by the width of the hand (4 inches) held at arm's length in line with the center of the road. (Matson, Smith and Hurd, Traffic Engineering, pp. 13-14.)

[11]U. S. Dept. of Commerce, p. 3.

This requirement is not intended to discourage imagination but merely to provide a basis for application of the standards and principles prescribed for use. In the case of automobiles, the standard is the Manual for Uniform Traffic Control Devices.

Similar consideration should be given to more general sign needs. Information signs at city street intersections should be posted in one of several accessible locations for the convenience of pedestrians and drivers, and bus stop and subway station signs should be placed so that both the sitting and standing passenger can see them.

There are three significant factors to consider in providing adequate time for response: (1) the speed of the user as he approaches the sign, (2) the legibility distance of the sign and its message, and (3) the longitudinal site of the sign.[12] These factors must be in a relationship which allows adequate PIEV[13] time plus time to maneuver the vehicle to its proper position.

J. B. Davey[14] has developed a formula which translates the number of words (N) on a sign, the average speed of vehicle in miles per hour (V), and the distance of the sign from the driver's (observer's) path in feet (S) and determines the approximate height of letters, in inches, necessary to insure an adequate reading distance. The formula is:

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[12]Matson, Smith and Hurd, Traffic Engineering, p. 138.

[13]PIEV stands for perception, intellection, emotion and volition. See Matson, Smith and Hurd, Traffic Engineering, pp. 20-24.

[14]J. B. Davey, "The Vision of a Group of Drivers," Brit. J. Physiol. Optics, April 1958.

$$h = \frac{(N+6)V}{100} + \frac{S}{10} \text{ inches}$$

Letter sizes worked out for various situations, assuming a sign with four names, are shown in Table 2:

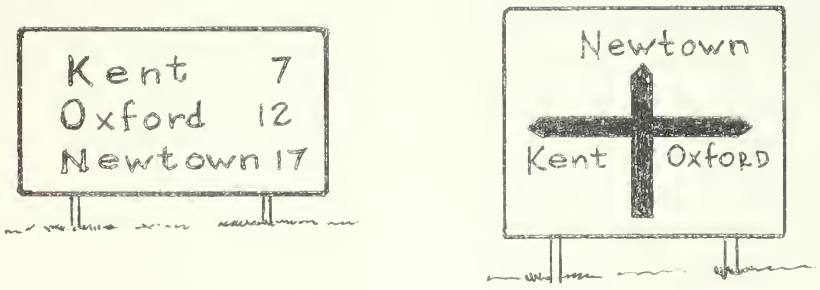
TABLE 2

Letter Sizes for Four-Name Signs*

V (Vehicle speed)	S (Distance of sign from vehicle path) 10 ft.	20 ft.	30 ft.	40 ft.	50 ft.
30 mile/h	4 in.	5 in.	6 in.	7 in.	8 in.
40 mile/h	5 in.	6 in.	7 in.	8 in.	9 in.
50 mile/h	6 in.	7 in.	8 in.	9 in.	10 in.
60 mile/h	7 in.	8 in.	9 in.	10 in.	11 in.
70 mile/h	8 in.	9 in.	10 in.	11 in.	12 in.

*Source: R. L. Moore and A. W. Christie, "Research on Traffic Signs," Engineering for Traffic Conference, July 1963, p. 113.

Even relative placement of a group of signs has an effect on the speed or accuracy of the response. In experiments conducted by the Road Research Laboratory in England[15] it was found that stack type signs, where a number of different names are placed above the others, were adequate for straightforward crossroads, but at complicated junctions a map type was best (see Fig. 5).



Stack Type Signs Map Type Signs

Fig. 5. Stack Versus Map Type Signs. At complicated intersections map types are better.

[15]Moore and Christie, "Research on Traffic Signs," p. 114.

The ability of the human mind to respond to written messages is a very interesting and complex subject. In the case of traffic signs, the more detailed the information the weaker the impression. For this reason, two identically placed signs with the same number of words may produce considerably different responses from users.

It has also been found that letters often produce little impression on memory in comparison to certain symbols, such as the arrow. Since many of our reactions are not the result of conscious thinking, but rather unconscious response to past thinking, any device which can promote clarity is a welcome one.

The word "clarity" probably best describes the basic feature most essential in any standard, for in its pursuit it appears that the best code would be established.

Having looked at the principles of signing, the next logical step is to examine the features of the sign itself.

CHAPTER III

THE LANGUAGE OF SIGNS

Signs speak a language derived from their three fundamental features--color, shape and legend.[1]

It would be difficult to find three better components from which to develop a system to be used for identification or provision of information. First of all, of the five senses available to man, nearly all perception is received through the eyes. Maximum utilization of visual codes capitalizes on this human characteristic. Secondly, color, shape and legend are the best coding methods found in practical use today; and third, color, legend and, to some degree, shape have psychological characteristics that add to their capabilities as easily identifiable codes.

Little more need be said about the human eye than that it perceives eighty-seven per cent of all sense receptions.[2] Since only seconds are needed to read signs,[3] visual identification is the most practical means of delivering information to an observer. The use of other senses can only be considered a reinforcement.

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[1]"Legend" is defined to mean both words and symbols.

[2]Julian Ellsworth Garnsey, "Light, Color and the Human Machine," Amer. Inst. Arch. J., Vol. X, No. 3, Sept. 1948.

[3]Measurements made by the Road Research Laboratory have shown that the scanning of signs takes about $\frac{N}{2} + 2$ seconds, where N equals the number of words on the sign. On an average the actual time will be about half this because the wanted word will sometimes be found first and sometimes last. (R. L. Moore and A. W. Christie, Research on Traffic Signs, paper published by the Road Research Laboratory for Engineering for Traffic Conference [Middlesex, England: Road Research Laboratory, July 1963].)

Table 3 compares and summarizes the advantages and disadvantages of visual coding methods as found in the book Human Engineering Guide to Equipment Design.[4] The comparison was devised to show the various methods used on equipment control panels to quickly identify knobs, dials or indicators. The original function of the table, however, does not make its results less applicable to this study.[5] It documents the superiority of the three features presently used on signs over any other codes.

The psychological character of color provides the most interesting but least understood feature of signs. For reasons still unknown to science, psychologists feel that certain identical principles underly the meaning given by most people to color, even though these meanings are taken from a variety of systems and sources.[6] For instance, in Middle Age heraldry, red stood for victory, triumph and dominance. In Roman Catholic liturgy, this same color means burning charity and sacrifice. A classification developed in Ancient Chinese culture combines color with points of the compass and several aspects of everyday life. Red stands for south, summer, heat and fire, among other things.

Many formalized color symbolisms stand out in our present-day proverbs and phrases. "Having the blues," "greenhorn," "doing it brown" are all known idioms. The difficulty encountered in trying to relate these uses back to a basic principle is understandable.

The concept of asscciation, or personal experience, once considered the classical explanation of the meaning given to color, is no longer

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[4]Clifford T. Morgan, et al. (Ed.), Human Engineering Guide to Equipment Design (New York: McGraw-Hill Book Co., 1963), p. 82.

[5]Based on interview with Dr. C. E. Sherrick, Research Psychologist, Psychology Department, Princeton University, May 1964.

[6]B. J. Kouwer, Colors and Their Character (The Hague: Martinus Nijhoff, 1949), p. 52.

TABLE 3

Comparison of Coding Methods*

Code	Maximum Number of Items(a)	Evaluation	Comment
Color	11	Good	Little space required. Location time short.
Numerals and Letters (Legend)	Unlimited for combinations of symbols	Good	Little space required if contrast and resolution are good. Location time longer than for color.
Geometric Shapes	Approx. 15	Good	Little space required if resolution is good.
Size	5	Fair	Considerable space required. Location time longer than for color or shapes.
Number of Dots	5	Fair	Considerable space required. Easily confused with other coded items.
Orientation of Line	12	Fair	For special purposes.
Length of Line	4	Fair	Will clutter display with many signals.
Brightness	4	Poor	Poor contrast effects will reduce visibility of weaker signals.
Flash Rate	4	Poor	Interacts poorly with other codes.
Stereoscopic Depth	Unknown	Fair	Requires complex electronic displays and special viewing equipment

(a) That generally will give overall accuracies of 95% or better.

* Source: Clifford T. Morgan, et al. (Ed.), Human Engineering Guide to Equipment Design (New York: McGraw-Hill Book Co., 1963), p. 82.

accepted.[7] Instead it is considered a possible motive, but no more.

In the case of the shape and legend of signs, psychological attitude is explainable in terms of association since in many cases the symbols have been specifically developed for use in traffic signs. There are certain dimensions and proportions that tend to make those forms more pleasing and therefore more effective, but discussion of these factors will be delayed until a later chapter.

Despite acknowledging their superiority as the features of signs, color, shape, and legend have definite limitations. In many instances, any one of the elements may be incapable of expressing any useful information without help from the other two.[8] The situation might be compared to a single word in the English language where, for example, the word "lead" may be a noun or verb and pronounced several ways. Without placing it in a surrounding that produces meaning--in this case a sentence--it is useless.

(1) I have lead the group.

(2) I will lead the group.

(3) Lead is a heavy metal.

In (1) and (2) "lead" is used as a verb but pronounced differently in each case. In sentence (3) the word is a noun and pronounced differently from the verb in (2). In each case the position of the word in the sentence and support given by other words develops the meaning shown.

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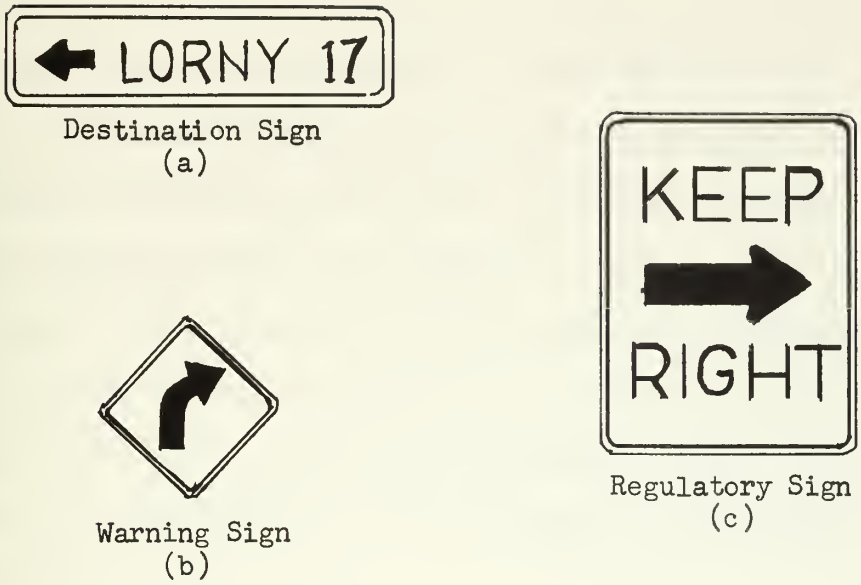
[7] Ibid., p. 53.

[8] William G. Eliot III states in his article "Symbology on the Highways of the World," Traffic Eng., Dec. 1960, p. 19: "Actually there are very few symbols, if any, that can express complete messages without association with other symbols, inscriptions, or previous experience on the part of the observer."



Destination Sign
(a)

Warning Sign
(b)

Regulatory Sign
(c)

Fig. 6. The Versatile Arrow

The arrow used so commonly throughout the world to provide direction is as lost as "lead" when disassociated with its surroundings and as versatile when replaced in a proper setting. It indicates the way toward a destination when used in conjunction with a geographical name (Fig. 6a). On a danger sign it forewarns of an impending situation and suggests the configuration of the roadway ahead (Fig. 6b). In a regulatory sign it specifies a requirement to proceed in a certain direction (Fig. 6c). Each sign shape is different. The background colors are white and yellow for the regulatory and warning signs, respectively, and may be white, green or some other color for the destination sign. But even more important than color or shape is the location of the sign within the context of the road system, pedestrian way, or station where it is to do its job. In an improper location the best sign impairs the worth of the system or network within which it is operating by being useless or even dangerous.

The final point of discussion is pertinent to both the general principles discussed in Chapter II and design principles in this chapter. It deals with a different aspect of sign communications. Many sign systems are in existence today that very few people know about, including those who could and should be using them. The reason is that few effective means have been devised or maintained to inform the prospective user, no key or legend that explains the reason for a ticket being colored blue or the significance of the varied color schemes found in certain buildings. Worse than a poorly placed sign, a practical coding system with no explanation as to how to use it is both a rebuke to the designer and a discourtesy to the public.

Two basic points have been stressed in this chapter. The first is that the codes presently used on signs are the best means available to communicate information to their users, and second, signs, whether individual or in a network, cannot provide adequate service to their users unless they are properly positioned and their meaning understood.

The next three chapters discuss in more detail the first point mentioned above, using the results of experiments conducted for a variety of reasons but all pertaining to color, shape or legend.

CHAPTER IV

THE LANGUAGE OF SIGNS--COLOR

Color is the most interesting and important feature of the language of signs. The eye sees nothing but color. Form, as we call it, is seen only because one color is placed against another and the shape is discernible as a result of position and contrast.[1]

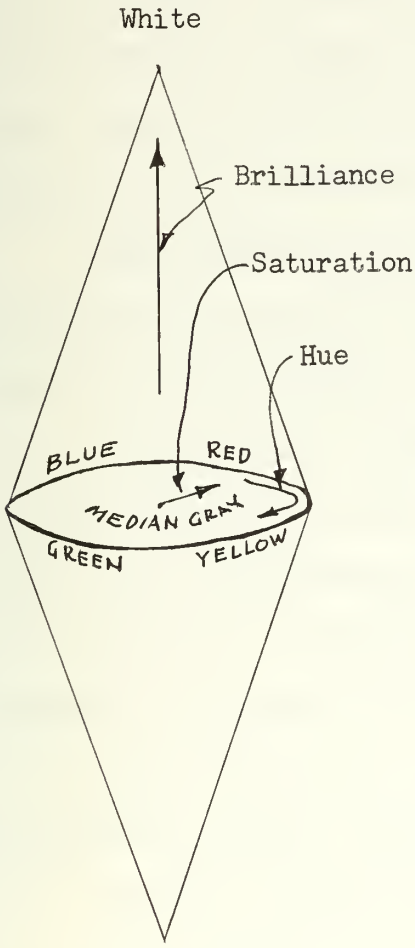


Fig. 7. A Color Spindle. (Source: Webster's New Collegiate Dictionary, 2nd Edition.)

All colors are divisible into two classes: chromatic, such as reds, greens, purples, browns and pinks, and achromatic, including black, white and the series of grays between. Figure 7 graphically illustrates this information plus introducing general terms used in describing color. Brilliance, hue and saturation are words meaning, in lay terms, the brightness, composition, and density of color.

Primary colors are described as those from which all other colors may be evoked by mixture.[2] However, there are various primary standards developed for particular uses. The one most applicable to this study is the psychological standard in which red, yellow, green, blue, black and white are the basic colors.

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[1]Technically, contrast is describable as either color or brightness contrast. Unless necessary, terms used throughout this chapter will be differentiated only to the degree necessary to insure the understanding of principles involved.

[2]Webster's New Collegiate Dictionary, 2nd Edition.

The comparison of coding methods tabulated in the previous chapter (Table 3) shows color to be one of the best methods of identification. As might be expected, the advertising industry has long been interested in the results of experiments conducted in the field of psychology to determine the capabilities of color as they relate to attention, perception, association, memory, and action. More recently these firms have developed their own staffs to carry out studies, but in the early 1900's principles used were based on results obtained from numerous experiments conducted under a variety of conditions. Nevertheless the principles found in early advertising textbooks[3] seem to have stood the test of time.

Many problems relating to color have been worked out in the laboratory, including attention value, preference and harmony, and the value of primacy and vividness as principles of connection.

Studies on color preferences by Jastrow[4] and Washburn[5] have shown that the primaries--red, blue, green,and yellow--are the most generally liked.[6] The specific order of preference, however, appears to be a function of the surrounding or background conditions. A University of Michigan experiment was conducted in which persons were asked to rank the order of

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[3]Henry Foster Adams, Advertising and Its Mental Laws (New York: The MacMillan Company, 1916).

[4]Jastrow, Popular Science Monthly, 1897, p. 361 ff.

[5]M. F. Washburn, "A Note on the Effective Values of Colors," American Journal of Psychology, Vol. 22, 1911, p. 114.

[6]A combination of data from 21,060 observers in 26 investigations on preference for single colors shows the following results in the order of best to least liked: Blue, red, green, violet, orange, yellow. Robert W. Burnham, Randall M. Hanes, C. James Bartleson, Color: A Guide to Basic Facts and Concepts (New York: John Wiley and Sons, Inc., 1963), p. 209.

merit (from most to least preferred) of different colors on three backgrounds: white, gray and black (Table 4).

TABLE 4

Order of Merit of Different Colors on Three Different Colored Backgrounds, from Most Liked (1) to Least Liked (6)*

Color	Background Color		
	White	Gray	Black
Red	3	5	5
Orange	4	6	2
Yellow	5.5	4	1
Green	2	3	4
Blue	1	2	3
Violet	5.5	1	6

*Source: Henry Foster Adams, Advertising and Its Mental Laws (New York: The MacMillan Company, 1916), p. 119.

This comparison might better be termed an evaluation of color harmony rather than preference. The results do show that with a large white background and a small color sample, blue is the most pleasing and yellow and violet produce the worst results. On the black background, yellow is the favorite. Using a gray background, the preferences nearly coincide with the spectral order of color, an interesting if not useful characteristic of color preference.

By varying the size of the color presented to the observer, a change in preference is often found.[7] Using small and large squares of

[7] If optimum color relations have been worked out for a composition of one size, they will probably need readjustment for the same composition in quite different size. Ibid., p. 217.

color in various tints and shades, it was found that red was preferred with the larger area and all others were preferred in the smaller area. With tints and shades[8] the larger areas were more preferred. The conclusion reached was that observers apparently can be pleased by large areas where the color tone is reduced in saturation, but where color is really condensed, large areas are likely to become distressing--or overpowering.

An analysis of color preference versus area ratio has recently been reported in Traffic and Engineering Control,[9] a British periodical. The object of the experiment was to determine the most suitable sizes and colors for signs when seen in daylight against a background of trees, hedges and fields. Even though conducted in rural surroundings, at least one exploratory test was undertaken in a city which correlated with results obtained under the standard conditions. In the conclusions, a portion of which are shown in Figure 8, it was determined that the area of colored signs should be greater or smaller than those of white background by the following percentages:

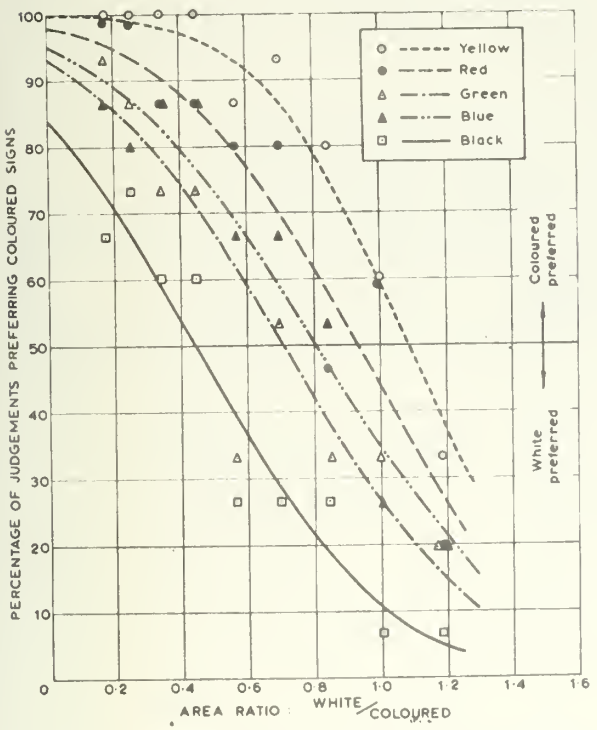

Fig. 8. Preference for Colored Sign versus Area Ratio (White/Colored).

(Source: P. Odeschaldi, "Conspicuity of Signs in Rural Surroundings," Traffic Engineering and Control, Nov. 1960, pp. 390-3, 397.)

[8] A tint is defined as a light or delicate touching with color. Shade is a degree of color. They are both combinations of saturation and brightness. Ibid., p. 15.

[9] P. Odeschaldi, "Conspicuity of Signs in Rural Surroundings," Traffic Engineering and Control, Nov. 1960, pp. 390-3, 397.

	per cent
'Lemon' Yellow (Approximating B.S.3810/355)	-10
'Signal' Red (" 3810/537)	+15
'Motorway' Blue (Approximating Interstate Blue)	+20
Green (Approximating Interstate Green)	+40
Black	+125

Another essential point in sign design is the harmonization of color and form. Experiments have been conducted in which forms of various shapes and colors were placed against a white background and relative preferences of a number of subjects noted. The results shown in Table 5 are the average position of preference, first through sixth, for each shape-color combination used in the experiment.

TABLE 5

Average Preference for Shape-Color Combinations of Fifty-Three Subjects Based on a Scale from 1 (Most Liked) to 6 (Least Liked).

Shape	Color of Shape Placed on White Background					
	Red	Orange	Yellow	Green	Blue	Violet
Circle	3.1	2.6	2.9	3.6	3.5	2.8
Perpendicular Ellipse	3.8	4.58	4.3	4.8	4.4	4.05
Horizontal Ellipse	5.33	5.4	5.8	4.98	5.3	5.35
Triangle-Up	4.0	3.6	4.0	3.4	3.8	4.2
Triangle-Inverted	4.7	4.52	4.6	4.4	4.8	5.3
Square	4.2	4.3	4.15	4.2	3.7	4.05
Perpendicular Rectangle	5.1	5.0	4.18	4.92	5.2	4.9
Horizontal Rectangle	5.32	5.6	5.6	5.4	5.0	5.1

This table shows that green is the least preferred color in circles and best liked in upright and inverted triangles; orange, violet and yellow best for circles; red and violet liked better than other colors in

perpendicular ellipses, whereas green and blue are preferred slightly in horizontal ellipses. The blue square is preferred with violet, and yellow next in order, and blue and violet are the most satisfactory for horizontal rectangles.

The study of color's emotional character is briefly presented here to complete this chapter. Many experiments have been conducted to determine the physical feelings that develop in humans when observing color. One of the most common evaluative methods used is the word preference test were colors and a prepared list of words are compared and a coupling of the two made. An example of one such test, conducted by Dr. B. J. Kouwer,[10] is shown in Table 6.

TABLE 6. Word-Color Association*

Color	Word	Per Cent Mentioning
Black	Death	64
	Night	58
White	Peace	63
	Nude	59
Red	Passion	75
	Emotion	71
Yellow	Jealousy	28
	Pleasure	25
Blue	Confidence	49
	Cooperation	38
Green	Nature	62
	Naturalness	30

*Source: B. J. Kouwer, Colors and Their Character (The Hague: Martinus Nijhoff, 1949), p. 178.

B. J. Kouwer, Colors and Their Character (The Hague: Martinus Nijhoff, 1949).

It is obvious from the results that the word responses used in the experiment have little value in developing a psychological basis for the use of color in a sign system. In fact, with the exception of the colors red, yellow and green, there have been no experimental data found for use in this study that link color to anything associated with traffic movement or control. Even the meaning given to these colors is founded more on association than on deep psychological principles. Their value has been developed through use on the high seas, by railroads, and now on the highways.

The experimental results shown above are only representative of the work that has been done in the field of color.[11] Each was presented, however, to provide a possible contribution to design problems that might be encountered in establishing a network of signs in buildings, subway stations or even on highways. No arbitrary and universally applicable set of rules is available for color selection, nor would this study attempt to devise one. More important would be the suggestion to insure consistent use, proper location and wide education regarding the standardized meanings of colors on signs. Color preference, connotation and legibility[12] are factors in good design, but color itself is not the answer to the sign problem. When it is already known that men and women, blondes and brunettes, rural and urban dwellers, young and old and the rich and poor have differing preferences for and associations with color, how could one system signify the same meanings to all?

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[11]For a current guide to basic facts and concepts on color, see Robert W. Burnham, Randall M. Hanes, C. James Bartleson, Color (New York: John Wiley and Sons, Inc., 1963).

[12]For information on color requirements for color-blind people, see Morgan, et al., p. 84.

CHAPTER V

THE LANGUAGE OF SIGNS--SHAPE

Shape was apparently the earliest recognizable feature of formal traffic signs. The milestone, found throughout the Roman Empire, presented a fairly standard appearance and provided travellers with information about routes and distances to cities and towns.

With the development of more and different means of transportation both the milestone and the feature of sign shapes lost their prime role as informants. The first has changed its appearance and location, usually found today at ten-mile intervals alongside the turnpikes as rectangular wood or metal signs mounted on posts. The second is now one of three features--color, shape and legend--found regularly on signs, still important but now working within a broader framework of design toward easier identification.

The number of different shapes a person can easily identify, or differentiate between, is quite large. If letters and numerals are considered as shapes, the number is practically unlimited. Since both of these are also classified as legends they will be left out here and discussed in Chapter VI.

In the case of geometric forms, tests conducted by R. B. Sleight[1] in 1952 showed that the number of highly discriminable shapes that can be learned and retained is about fifteen. Figure 9 shows his results. These

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[1] R. B. Sleight, "The Relative Discriminability of Several Geometric Forms," Journal of Exp. Psychol. 43, 1952, p. 324.

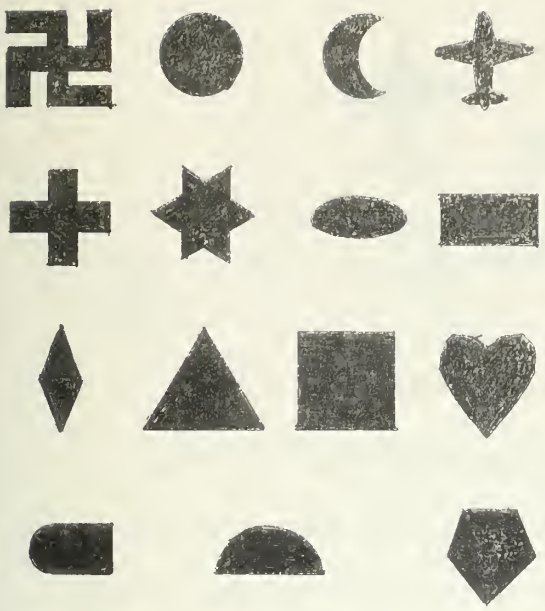

Fig. 9. Easily Identified Geometric Shapes (From C. T. Morgan et al., Human Engineering Guide to Equipment Design, New York: McGraw-Hill Book Co. Inc., 1963, p. 85.)

shapes were found to be identifiable nearly 100 per cent of the time if their largest dimension measured at least twelve minutes of visual angle. Translated into more useable terms, the figure's largest dimension had to be two inches for each fifty feet of distance from the observer (see Fig. 10).

The most effective use of shapes in aiding identification is found where they are compatible, or have an association value with the system, function or object coded. For example, an airplane silhouette would be

$$\underset{\text{(12 minutes of visual angle)}}{\frac{12}{180 \times 60}} \times \underset{\text{(Distance in feet to the object)}}{50} = .1745 \text{ feet or } 2 \text{ inches}$$

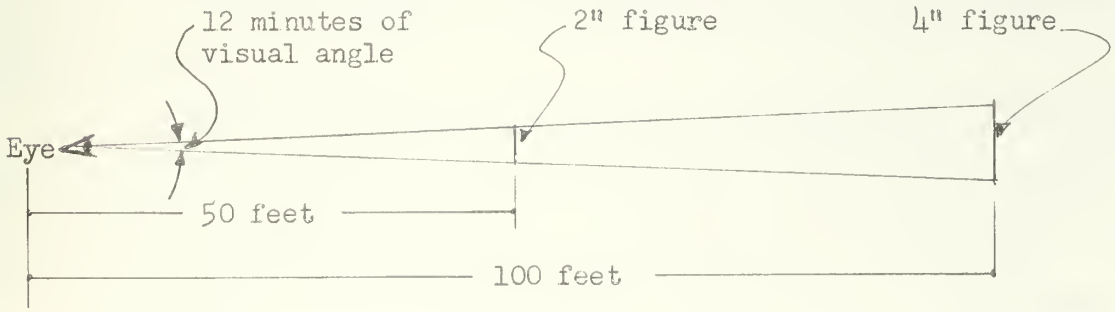

Fig. 10. Conversion of Visual Angle into Inches at Distances of Fifty and One Hundred Feet.

used to better advantage at an airport to assist in informing passengers of the direction to a loading platform than it would at a bus station (Fig. 11).

Fig. 11. Flow Signs at Gatwick Airport, England.

Contrast and sharp outline are not the only factors to be considered in the use of shapes for identification. Attention is naturally directed to simple, regular shapes[2] when signs are placed in a street environment. where irregular patterns, caused by the multiplicity of forms found in the city, act as a background. For this reason, the more irregular patterns shown in Figure 9 might be better used in a somewhat controlled environment, such as in subway or bus stations, or on a plain sign surface as secondary identification such as the airplane shape used on the sign shown in Figure 11.

Varying the size of a shape has been used effectively for identification on consoles or equipment panels. The variation usually correlates with a certain characteristic of the coded item. A common example would be the use of concentric small and large knobs for coarse and fine tuning of radio equipment.

In experiments conducted using isosceles triangles of the shape and within the range of dimensions shown in Figure 12, it was found that five individual sizes could be consistently distinguished from one another.

Although expressed in arc dimensions, the pattern of size changes shows a definite logarithmic growth, each larger triangle adding an increment

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[2]Theodore M. Matson, Wilbur S. Smith, Frederick W. Hurd, Traffic Engineering (New York: McGraw-Hill Book Company, Inc., 1955), p. 314.

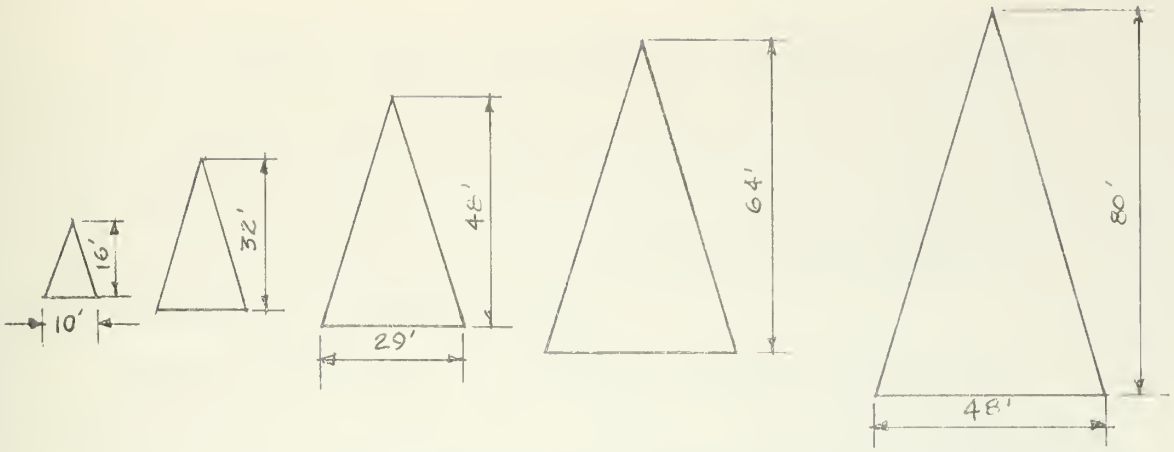

Fig. 12. Similar Triangle Sizes Consistently Distinguishable from One Another Expressed in Minutes of Visual Angle (Not to Scale).
(Developed from discussion of subject in C. T. Morgan et al., Human Engineering Guide to Equipment Design, New York: McGraw-Hill Book Co., 1963.)

approximately equal to the original, or base, dimension. Using this principle, a sign shape with an initial dimension of one foot on a side would be increased by one-foot increments for each adequately different size. If more than five sizes are used within the range shown in Figure 12, the possibility for error increases rapidly. Figure 13 shows the results obtained when the number of sizes used within this same range were increased.

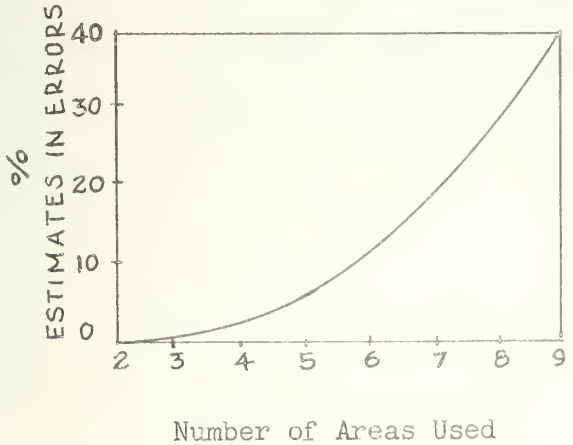

Fig. 13. Estimated % of Error in Differentiating Size of Shapes vs. Number of Shapes Within Specified Range of Sizes. Min. Size 10x10; Max. Size, 48x80 min. of Visual Angle. (From Morgan et al., Hum. Eng., p. 85.)

The pleasingness of many shapes has been investigated experimentally. Returning to the field of advertising for information, H. F. Adams[3] states that the most frequently used figures are triangles, rectangles, circles, and ellipses. Quoting Mr. Adams:

[3] H. F. Adams, Advertising and its Mental Laws (New York: The MacMillan Co., 1916), p. 270.

"The triangle, because it is made up so largely of diagonal lines, is called lively, incisive, yet it is at the same time well balanced. Experiment has shown that the most pleasing triangle, when resting on its base, is the one whose altitude is approximately 1.50 times its base."

"Certain proportions of rectangles have been found to be much more pleasing than others. Zeising, because of theoretical considerations, and Fechner, on experimental grounds, argued that a rectangle having its sides in the ratio of the golden section, was the most pleasing. The golden section is the division of a line into two parts of such a length that the short part is to the long part as the long part is to the sum of the two parts. This gives a ratio of roughly 1.00 to 1.62, or approximately 5 to 8."

For ellipses, "the curved lines make the figure more graceful than the more severe rectangle and tend to unify the content in a better manner. Experiments have again indicated that the most pleasing proportions for an ellipse are found when the long axis and the short axis bear approximately the relation of 1.00 to 1.50 to each other."

Table 7 shows the results of experimental data which followed and supported the discussion shown above.

A discussion of composition is included at this point because of the very important relationship between the shape of signs and the symbols, color, or lettering placed on them. Each of these components, in themselves, constitute shapes and must be properly positioned in order to produce a

TABLE 7

Proportions of Geometrical Forms Producing the Most Pleasing Appearance to Observers in Terms of Per Cent of Choices*

Proportion of Sides	Per Cent of Choices	
	Rectangles	Ellipses
1/1	3.05	1.2
6/5	0.35	0.6
5/4	1.54	8.3
4/3	2.66	14.7
29/20	8.60	-
3/2	19.77	42.4
34/21 (Golden Section)	35.17	16.7
23/13	19.31	13.1
2/1	8.09	1.6
5/2	1.56	0.0

*Source: H. F. Adams, Advertising and Its Mental Laws (New York: The MacMillan Co., 1916), p. 270.

harmonious design. Haphazard composition can easily reduce the pleasantness and, perhaps, usefulness of a sign.

A design principle known as the Greek Law of Area deals with the problem of composition in a somewhat abstract way but is still worth mentioning. Found in a book entitled Principles of Advertising Arrangement,[4]

[4]Frank Alvah Parsons, The Principles of Advertising Arrangement (New York: The Prang Company, 1912), p. 22.

the author states:

"If you have a ratio between three widths or three sizes which is approximately as five is to seven and eleven, you will have nearly what the Greeks thought were the most comfortable abstract proportions."

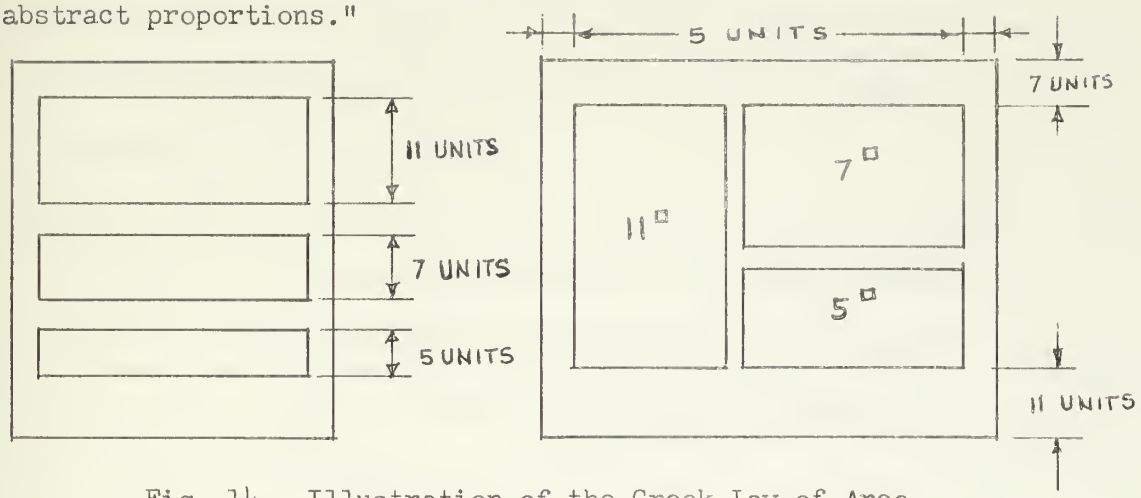

Fig. 14. Illustration of the Greek Law of Area.

Figure 14 illustrates the principle graphically. Both the proportions of paragraph lengths shown in (a) and the areas shown in (b) are governed by this rule. The margin spacing shown is explained by the statement:

"The most pleasing and effective marginal arrangement is to have the widest margin at the bottom, the top next, and the sizes next.

"Now again, the relation of these widths--the widest at the bottom, the next at the top, and the two sides less and alike--should be in the ratio of eleven units to seven and five, to get the best proportion. This then is the first application of the Greek Law to the margined page, no matter what the page has included in it--printing, ornaments or other matter."

A second related principle also discussed in this book involves the relationship which should exist between individual shapes in a composition. It is called the principle of consistent shapes. Summarizing the discussion, the essentials are:

(1) Shapes, as sizes, should not be too much alike nor too radically different from each other to appear together pleasantly and convincingly.

(2) The two most radically different things that can be found in form, and the most monotonous, are the square and the circle, the first because the four sides are equal in length, the second because it has a uniform change of direction throughout.

(3) The elliptical curve offers more variety than a circle, the oval more than the ellipse because of their increasing irregularity of change.

(4) There is more interest in an oblong, or rectangle, than a square because of the different lengths of its two sides.

(5) The use of a square and circle together is inconsistent since they are the two most widely separated shapes. Used together they produce the greatest contrast possible and therefore should be reserved for a situation or function that demands this contrast.

Finally, the need to utilize these principles in a complete composition must be discussed. Assuming that the basic principles of the Law of Areas and related shapes are understood and followed, the problem resolves into the necessity of preventing a composition of consistent but badly placed shapes.

There are too many variables to lay down hard and fast rules. Experience, either personal or professional, is a solution. Mr. Parsons, author of Principles of Advertising Arrangement, points out the problem in this way:

> "I should judge. . . , if a man doesn't know of the possibilities of arrangement, he may select an excellent shape in type and decorative units and yet have a bad result, because there is no thought upon the arrangement."

The rules, or guidelines, presented on design so far have obviously been from references dealing with advertising principles. This fact does little to invalidate their use in this study since public signs should be as well thought out and pleasing in their design as a good commercial sign. The references quoted are also quite old. No more current books were found that dealt with the principles underlying composition as well as did those used. However, modern advertising textbooks have added some useful refinements on layout.

In Psychology for Advertisers,[5] the authors specify that a balanced layout, which is the first principle of good design, can be determined by both psychological factors and mathematical laws. There is a focal point, or optical center, present in all advertisements. It is located slightly above the middle of the layout directly on a line that runs down through its center (Fig. 15). A good composition is achieved by balancing the design about the optical center.

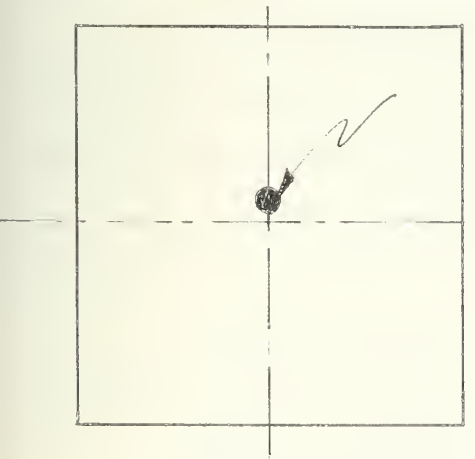

Fig. 15. The Optical Center of Display.

[5] D. B. Lucas and C. E. Benson, Psychology for Advertisers (New York: Harper and Brothers Publishers, 1930), p. 152.

Balance is normally accomplished in one of two ways. The first is by a static, or formal, arrangement where the elements to be used in the advertisement are mathematically balanced about the center-line. This format is easy to read and is thought to infer superior quality and good taste.[6] The second means of producing a balanced design is by the use of the vital, or informal, format. The elements used here are psychologically balanced, or weighted, by varying the size, shape, intensity of color and distance from the optical center. Small sizes at long distances balance large sizes closer to the middle. Small dark elements can balance equally distant large and lighter colored ones. The principle evolves to balancing each half of the advertisement by equalizing the weights produced by the size, color and distances of the elements on each side.[7]

In preparing a layout the designer does not mathematically compute these weights to determine whether balance has been achieved. The trained eye must develop a facility for this problem and detect and rearrange until a more pleasing effect is obtained. The need for experience and thought in developing a good composition still remains the essential consideration in modern advertising layout.

As this chapter has shown, the meaning of shape, and its use, can be broadly defined. The subjects of size and composition could have been deleted and discussed separately, but several interesting relations brought out might have gotten lost in the process. First, size can be classified

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[6]Thomas E. Maytham, Introduction to Advertising Principles and Practices (New York: Harper and Brothers Publishers, 1948), p. 155.

[7]Robert V. Zacher, Advertising Techniques and Management (Homewood, Illinois: Richard D. Irwin, Inc., 1961), p. 142.

as a variation of shape, and secondly, composition is the proper arrangement of consistent shapes and sizes.

One aspect of shape not even mentioned so far is its psychological significance. Unfortunately, nearly all of the deeper meaning of shapes, like color, have been lost, even though the earliest written languages were wholly dependent on them.[8] The triangle, which is widely accepted as a symbol with deep religious significance, is one of the few exceptions.

The shapes of two triangles found in experiments in this chapter can also be used to point out an interesting relationship. Their similarity supports the contention that form and function, or beauty and efficiency, in design are one and the same. The first triangle was the one used in a discrimination test (Fig. 12). The other was chosen as having the most pleasant proportions (Table 7). The two figures are shown, superimposed, in Figure 16.

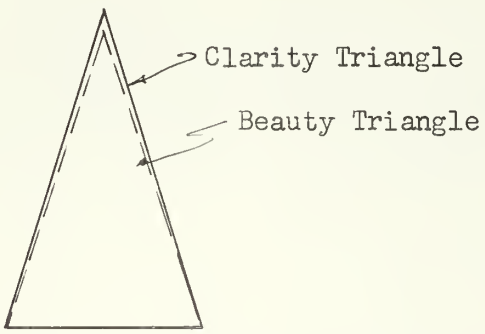

Fig. 16. The Beauty and Clarity Triangles

Circumstances in traffic sign design may require that certain principles discussed here be sacrificed. Standardization of sign shapes will require that a variety of information in many forms and sizes be placed on them. Legibility may necessitate sacrifice of the most pleasing

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[8]Lancelot Hogben, From Cave Painting to Comic Strip (New York: Chanticleer Press, Inc., 1949), p. 78.

composition, but in general, and particularly on interior information and directional signs, more attention should be given to the quality of the over-all product rather than to merely producing "a sign."

The remaining points to be stressed can be summarized as follows:

(1) The average person can recognize and retain the meaning of approximately fifteen distinctive symbols.

(2) The use of simple shapes is recommended in order to contrast with the complex forms produced by the cityscape.

(3) The use of a single shape in different sizes for a coding system of any magnitude is impractical.

(4) Certain shapes, and proportions of those shapes, are most pleasing to the eye.

(5) Good design and layout of signs can increase their effectiveness.

CHAPTER VI

THE LANGUAGE OF SIGNS--LEGEND

Signs may display any of three forms of legend--words, pictorial symbols, or abstract symbols. They usually use one, but seldom all three types, to provide the user with the message for which the sign was devised. The meaning of "words" as a legend is obvious. STOP, SLOW, PEDESTRIAN CROSSING are examples. Pictorial symbols are figures that resemble, as a picture, the thing they represent. An abstract, or arbitrary, symbol is a figure that has been assigned a certain function and has gained meaning through indoctrination and use. Figure 17 shows examples of each type.

Word Pictorial Abstract

Fig. 17. Highway Signs Using Word, Pictorial and Abstract Legends.

A basic difference exists today between the proponents of the continued wide use of word legend and those who feel that symbols are better. Words provide a reader with the exact meaning of a sign. Symbols can usually be expected only to infer meaning, even though the inference may be lengthy and detailed.

Uneven Road Bump

Fig. 18. Examples of Symbolic and Word-Signs Indicating a Special Road Condition.

In Figure 18 the sign on the left, which is used in the European system of road signs, indicates that an uneven road lies ahead. Whether the unevenness is due to a hole, bump, dip or other irregularity is unknown. The sign on the right, from the U. S. standards, is very specific, leaving no doubt that the obstruction will be a bump. Just how important the need is for such exact knowledge is an important question.

More essential than what kind of unevenness lies ahead might be the action that should be taken to cope with it. The obvious answer is to slow down. If both signs produce this result, either sign is adequate.

Carriageway Narrows Narrow Road Narrow Bridge

Fig. 19. Examples of Symbolic and Word Signs for a Narrow Roadway.

Other comparisons are not so straightforward. Figure 19 shows the European and several American signs which define a narrowing roadway. The European standard is apparently used in all situations, whereas U. S. roads have at least four separate word signs to indicate more specific information about the same situation. They are: Narrow Road, Narrow Bridge, One Lane Bridge, and Pavement Narrows. The question is what do these separate word signs do that a single symbolic sign cannot?

Attitude toward proper speed and safety is undoubtedly greater when crossing a narrow bridge than when on a narrow roadway. The road usually has shoulders to provide extra room in case of an emergency. Therefore, a person with more specific knowledge of the roadway conditions ahead would have a greater margin of safety.

The one factor in Europe which overcame any doubts about the use of a predominantly symbolic system of sign language was the number of languages spoken. Since travel between countries is common, a common road sign vernacular was considered necessary. The same situation does not exist in this country today, and the necessity for "pictures" to be used where words can provide more exact meaning does not seem essential to U. S. highway officials. This difference in philosophy will be obvious in both the reference material cited and pictures shown illustrating the essentials of the word language and symbols necessary for effective legends.

Word Language. A wealth of useful material has been published about the various and most effective uses of letters, numbers, and words in both the scientific field and in the sphere of fine arts and architecture.

As an outline of important points to cover, the following paragraphs are quoted from the Manual on Uniform Traffic Control Devices:[1]

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[1]U. S. Dept. of Commerce, pp. 15,16.

"(1)Word messages should be as brief as possible,[2] and the lettering large enough to provide the necessary legibility distance.

"(2)Abbreviations should be kept to a minimum and should include only those words commonly recognized and understood, such as Ave., Blvd., N. (for north), R.R., or Jct. Two-word place names, where one is a common geographical designation, like E. Lansing, Rockville Ctr., or Cleveland Hts., can often be acceptably abbreviated, but other abbreviations or contractions, like Gd. Rapids, S. Francisco, N. Brunswick, Newp't News or Homest'd are objectionable and should be avoided. Since long names can often be partially recognized by their length, it is sometimes permissible to put them in slightly smaller lettering than would otherwise be required.

"(3)As a guide to choice of alphabets, tests have shown that, for any given legend, better legibility can be obtained by using relatively wide spacing between letters than by using wider or taller letters with a cramped spacing."

Legibility distance is influenced by (1) alphabet design, (2) letter height, (3) letter width, (4) letter stroke,[3] (5) letter spacing, (6) sign margin, (7) word and line spacing, and (8) contrast in color and brightness.[4]

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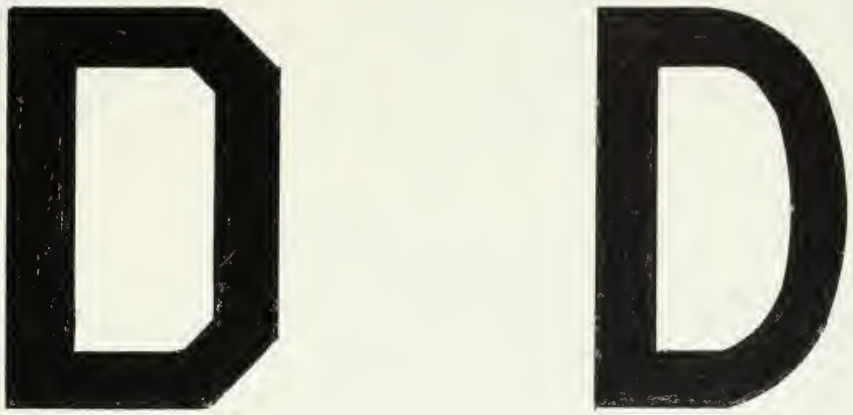
[2]Not more than three or four familiar words can be conveyed at a glance, according to Cf. T. W. Forbes, "A Method of Analysis of the Effectiveness of Highway Signs," Journal of Applied Psychology, Vol. 23, No. 6, December 1939, pp. 669-684.

[3]The thickness of the lines produced in writing the letter.

[4]Matson, Smith and Hurd, p. 316.

The Bureau of Public Roads has six standard lettering sizes (series A through F shown in Figure 21) that have been developed for use on highway signs.[5] The designs are simple, using rounded-block-style letters (Fig. 20) for greater legibility[6] and constructed so that adjacent series are each



Pure Block Style Rounded Block Style

Fig 20. Comparison of Pure and Rounded Block Style Lettering.

legible at somewhat greater distances. For example, series B, C, and D letters are legible in daylight at distances of 33, 42 and 50 feet, respectively for each inch of letter height.[7]

Letter spacing varies depending on the shape of the letters. Adjacent letters with parallel strokes, like "ND", are spaced farther apart than those where the strokes are diverging, such as "HA." Spacing between words and lines is apparently satisfactory when three fourths of the letter width is allowed.

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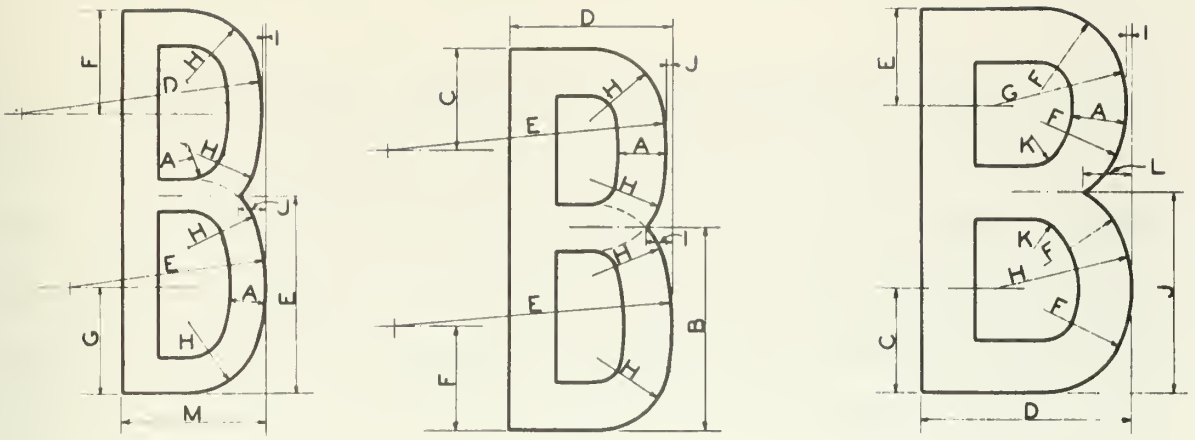
[5]Series A is no longer used for highway sign markings. (U. S. Department of Commerce, p. 16.)

[6]Rounded-block-style letters yield about five per cent greater legibility distance than pure block letters because of the parallel adjacent strokes which develop in pure block-letter sequence. See Figure 20 (Matson, Smith and Hard, p. 316).

[7]Ibid., p. 317.



SERIES A LETTERS

HEIGHT (INCHES)	DIMENSIONS (INCHES)																		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
2	3/16	7/8	1/2	1 1/4	1 1/32	17/32	9/16	3/8	1/64	9/64	9/32	15/16	3/4	11/32	7/16	4 1/2	1/32	21/32	5/16	43/64
3	9/32	1 5/16	3/4	1 7/8	1 35/64	51/64	27/32	9/16	1/64	13/64	27/64	1 13/32	1 1/8	33/64	21/32	6 3/4	3/64	63/64	15/32	1
4	1/8	1 3/4	1	2 1/2	2 1/16	1 1/16	1 1/8	3/4	1/32	9/32	9/16	1 7/8	1 1/2	11/16	7/8	9	1/16	1 5/16	3/8	1 11/32
18	1 11/16	7 7/8	4 1/2	11 1/4	9 9/32	4 25/32	5 1/16	3 3/8	1/8	1 1/4	2 17/32	8 7/16	6 3/4	3 3/32	3 15/16	40 1/2	3/32	5 29/32	2 13/16	6 1/16

SERIES F LETTERS

HEIGHT (INCHES)	DIMENSIONS (INCHES)																	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
2	3/8	2 1/4	7/16	1 27/32	17/32	9/16	5/16	7/32	9/32	1 1/16	3/32	1 1/32	1/32	1	1 9/16	1 19/32	7/8	11/16	23/32
3	9/16	3 3/8	21/32	2 49/64	51/64	27/32	15/32	21/64	27/64	1 19/32	9/64	1 35/64	3/64	1 1/2	2 11/32	2 25/64	1 5/16	1 1/32	1 5/64
4	3/4	4 1/2	7/8	3 11/16	1 1/16	1 1/8	5/8	7/16	9/16	2 1/8	3/16	2 1/16	1/16	2	3 1/8	3 3/16	1 3/4	1 3/8	1 7/16
18	3 3/8	20 1/4	3 15/16	16 19/32	4 25/32	5 1/16	2 13/16	1 31/32	2 17/32	9 9/16	27/32	9 9/32	9/32	9	14 1/16	14 11/32	7 7/8	6 3/16	6 15/32

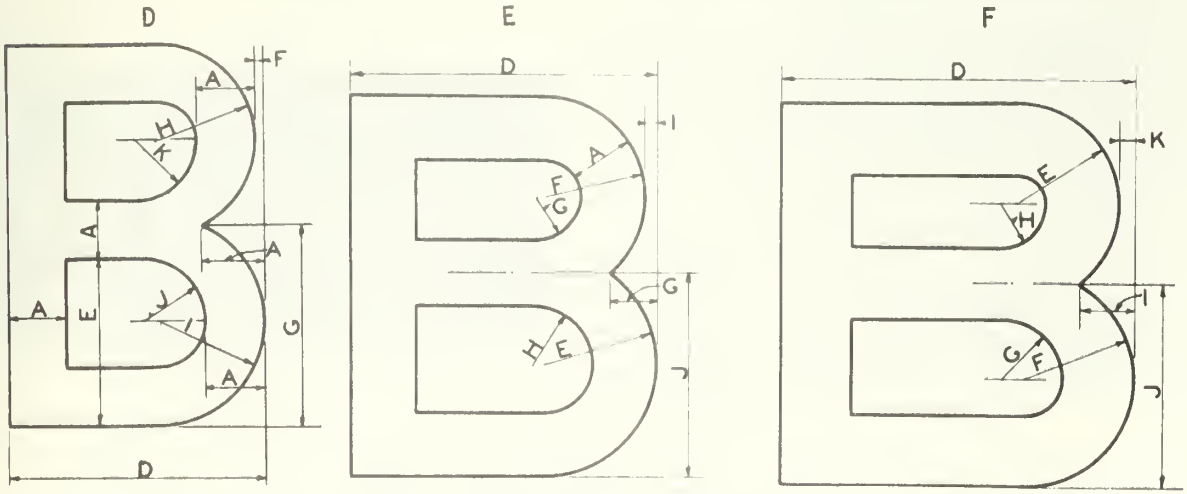
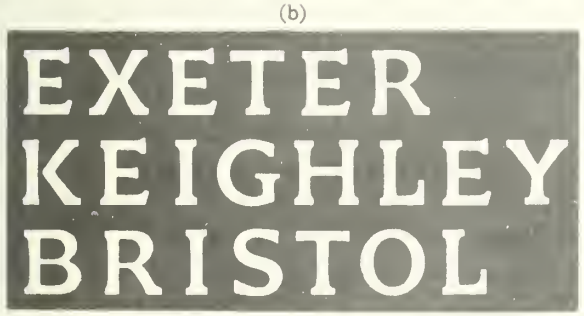


Fig. 21. Examples of U. S. Department of Commerce, Bureau of Public Roads Standard Lettering Sizes. Series A through F. (Adapted from U. S. Department of Commerce STANDARD ALPHABETS FOR HIGHWAY SIGNS, 1961.)

Although capital lettering is a near standard for highway signs, claims for greater legibility have been made by advocates of the use of lower case lettering.[8] The theory advanced is that the breakup of rigid top and bottom conformity of the line of capital letters increases legibility. Original tests conducted used single name destination signs and results indicated that drivers were able to see the lower case style at a distance ten per cent greater than those composed entirely of capital letters. Critics have pointed out discrepancies in testing procedures and other limitations,[9] but the use of this new style appears to be growing.

(a)

(b)



(c)

Fig. 22. Examples of the Signs Used in a Comparison of Upper and Lower Case Lettering. The three signs have the same area. The relative legibility distances were (a) 100, (b) 103, (c) 100. (Source: R. L. Moore and A. W. Christie, "Research on Traffic Signs," Road Research Laboratory publication for Engineering for Traffic Conference, July 1963, p. 116.)

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[8]T. W. Forbes, Karl Moscowitz, Glen Morgan, "A Comparison of Lower Case and Capital Letters for Highway Signs," Highway Research Board (Washington: Highway Research Board, 1951), pp. 355-73.

[9]Milner Gray and Ronald Armstrong, Lettering for Architects and Designers (New York: Reinhold Publishing Corporation, 1962).

A paper published in July 1963 by the Road Research Laboratory[10] provides a variation on the argument concerning the relative merits of upper and lower case lettering. Figure 22 shows both styles plus a modified form of lettering which was tested and proved to be more legible than either of the two (about three per cent). However, the difference appears so small that there seems little choice between any of the styles based on legibility alone. Perhaps esthetics might in some cases decide the most practical choice.

The experiment brought out two additional facts as aside comments that are worth mentioning for possible future use:

1. Lower case letter signs are generally taller but narrower than equally legible upper case signs. This characteristic might be useful when considering placement of signs in narrow congested areas or where vertical shapes are required.

2. Words like slow, stop, danger, police presented themselves more forcibly when written as SLOW, STOP, DANGER, POLICE, suggesting that upper case might be used for all mandatory and warning signs.[11]

Legibility distance is affected by one additional factor beside those shown, the variation in the seeing ability among observers. Even in road users with 20/20 vision, the range of clearly distinguishable letter series may vary from between 300 and 700 feet.[12] Figure 23 shows average clear sight distances for road users with 20/20 vision when viewing several

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[10] R. L. Moore and A. W. Christie, "Research on Traffic Signs," Road Research Laboration publication prepared for the Engineering for Traffic Conference, July 1963, p. 116.

[11] The U. S. Manual already requires this stating in Section 1A-15, "With the exception of destination names on guide signs, sign lettering shall be in clear, open capital letters. . . ."

[12] Matson, Smith and Hurd, p. 316.

series and types of signs. Notice that the curvilinear increase in legibility distance changes to a linear increase as letter height grows.

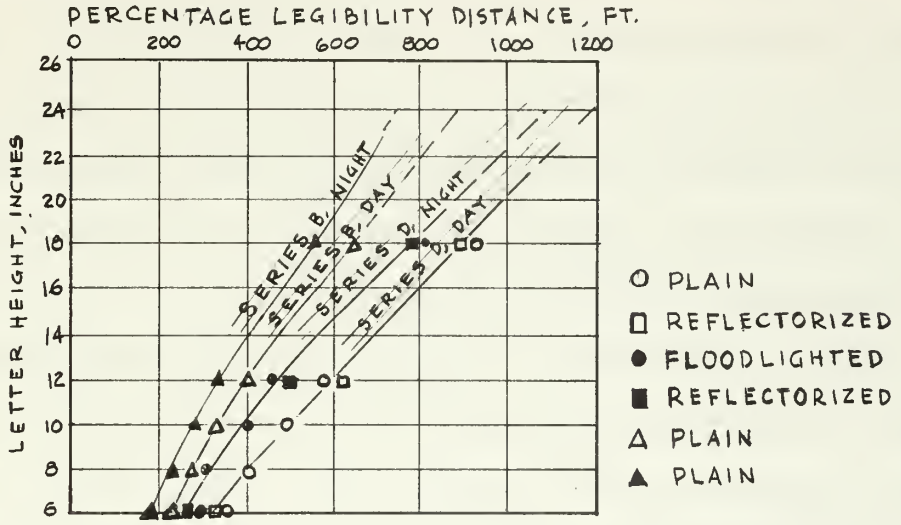

Fig. 23. Practical Legibility Values Corresponding to 20/20 Vision, 80 Percentile Figures. (From T. W. Forbes and R. S. Holmes, "Legibility Distances of Highway Destination Signs in Relation to Letter Height, Letter Width and Reflectorization," Proceedings of Highway Research Board, Washington, 1939, Vol. 19, p. 331.)

The Manual on Uniform Traffic Control Devices states that for signs "where a word message is applicable the wording shall be as herein approved."[13] If this same requirement were broadened to include the signs now used to inform and direct pedestrians and public transportation riders, the present situation of confusing and potentially unsafe word messages would be eliminated. As it now exists, pedestrian roadways are designated by signs which display the word walkway. But to a driver approaching an intersection it is termed a crosswalk. An exit can be called an "off ramp" on highways or simply "out" in other situations. Similarly, store entrances are marked as "In" or "Enter," a lane is also an aisle and "Go" for pedestrians is spelled W-A-L-K. Any comprehensive study to analyze the needs of a broadened

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[13] U. S. Department of Commerce, p. 12.

standardization of signs would certainly be required to consider improvements in word messages.

Symbols. As stated earlier, symbols can be divided into two classes. Those that are pictorial, or picture-like in appearance, are designed to express a complete message without association with other symbols, inscriptions or previous experience on the part of the observer. The abstract symbols depend on a more or less arbitrary code of meaning, without reference to an observable item or being (see Fig. 17 for an example of both).

A number of questions arise when discussing the usefulness of symbols in a traffic control system. These include the ease of learning the use and meaning of symbols, the long-term applicability or non-obsolescence of the symbols chosen, the clarity of observation at varying distances and under different conditions, and practical adaptability to use on a wide basis.

Of the two types of symbology, pictorial representation would appear to be the easiest to learn because of the association the symbol has to the real life situation. Unfortunately, the wide variety of requirements placed on signs has apparently gone beyond the capabilities of pictures to describe. For this reason, abstract symbols are commonly found even in the European traffic sign system, which is based on the use of pictorial symbolization.

Obsolescence is another factor which can produce problems in the use of pictorial symbols. The International Road Sign Standard uses the silhouette of a steam locomotive to mark a railroad crossing (Fig. 17). In Europe, as in this country, steam locomotives are being withdrawn from

service.[14] The day will soon come when the trains that flash by railroad crossings will all be diesel powered and bear no pictorial resemblance to the sign symbol representing them.

Unfortunately, the sleek appearance of the deisel trains provides a very poor silhouette from which to develop a distinctive and easily recognizable substitute. If the steam locomotive form continues to be used to identify railroad crossings, it will provide an example of a pictorial symbol becoming an abstract one in the span of a few years.

Obsolescence through technological changes is only one of a number of ways that picture signs can prove ineffective. A different type was reported in the March-April 1957 issue of Transit,[15] the magazine of the New York City Transit Authority. Pictorial mosaics were installed in all subway stations of that city in the early 1900's, apparently designed for use by the many newly arrived immigrants who were unable to read English. Recently a study to determine the meaning of each was undertaken and ran into some real difficulties. The reasons, after looking at the examples shown in Figure 24 on the following page, are understandable. Not only did the designs become rapidly obsolete because of reference to buildings and churches that were soon torn down or remodeled, but even the symbol referring to a more famous object, such as Robert Fulton's steamboat, The Claremont, was not universal enough to be practically adaptable.

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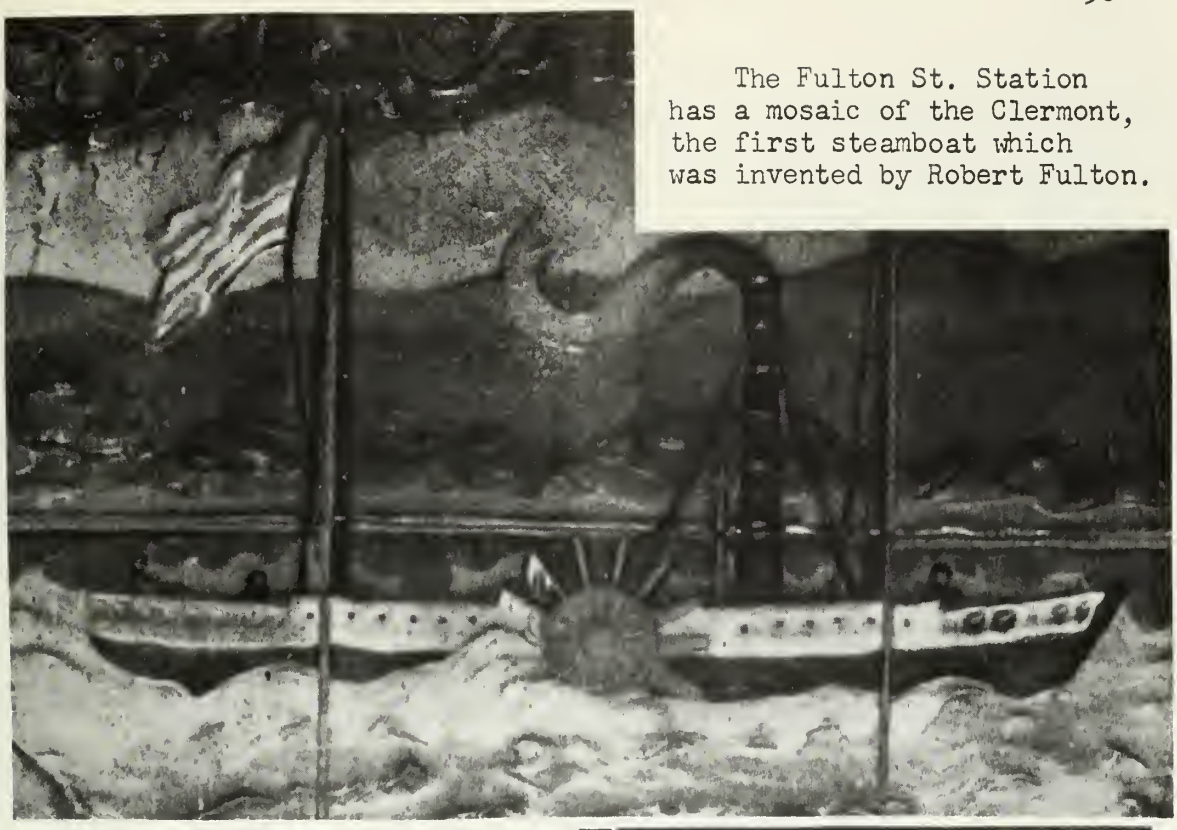
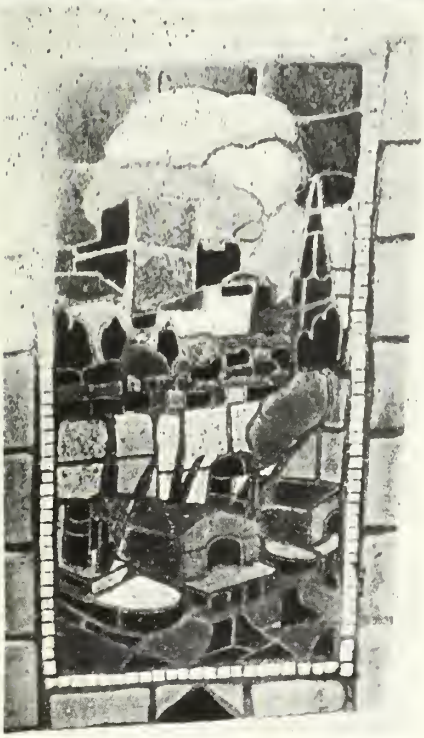
[14]Steam locomotives in the United States have dwindled from over 64,000 units in 1929 to 112 in 1961. No railroads currently use steam engines to provide regular passenger or freight service. (American Association of Railroads, Railroad Transportation, A Report Prepared by the Bureau of Railway Economics [Washington: American Association of Railroads, 1962].)

[15]"The Great Subway Art Mystery," Transit, Vol. 4, No. 3, March-April 1957, pp. 6-9.



The Fulton St. Station has a mosaic of the Clermont, the first steamboat which was invented by Robert Fulton.



Clark St. Station showing 1900 Waterfront there.

Christopher Columbus' flagship is found at the Columbus Circle Station.

Fig. 24. Mosaic Pictures Located in the New York City Subway Stations Used for Guides for Illiterate Travellers in the Early 1900's. (Source: New York City Transit Authority, Transit, Vol. 4, No. 3, March-April 1957, pp. 6-9.)

A comparison of International with U. S. Standard road signs was published in 1950 by the U. S. Department of Commerce, Bureau of Public Roads.[16] There have been sign changes and additions since the publication was issued but the discussion of principles and problems set forth is indicative of the attitude of U. S. officials involved in the developing of the traffic control devices in this country. In summary, the comparison stated:

(1) The International Standard, which conveys as many messages as possible by symbols alone, inevitably results in a somewhat complicated system of shapes and colors.

(2) A written standard allows messages to be self-explanatory without reference to shape or color of sign.

(3) Symbol standard is often meaningless without reference to a sign code.

(4) U. S. Standard symbols are generally self-explanatory.

(5) Additional color used in the International Standard results in some complication in manufacturing, each color adding an additional step in the manufacturing process.

(6) U. S. symbols are well adapted to reflectorization due to simplicity of shapes.

(7) Many international signs can be reflectorized only by a difficult application of two colors of reflecting coating.

No comparable report from any European sources was found for comparison purposes, but experiments have provided some evidence that the

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[16] U. S. Dept. of Commerce, A Comparison of the International Standard Road Signs with the United States Standard Road Signs (Washington: U. S. Department of Commerce, 1950). The International Standards were derived from the "Protocol on Road Signs and Signals" issued by the United Nations Conference on Road and Motor Transport, September 19, 1949, and have been adopted almost completely by European nations.

solution is not as one-sided as that shown above. In fact, even the Commerce Department report recognized this when it stated, "Both [standards] might gain by mutual borrowing." Later, work done by the United Nations Transport and Communications Commission to improve the International standards did just that,[17] adopting several signs modeled after those in the Manual. U. S. intentions toward a wider use of symbols are probably best expressed by a statement of the National Joint Committee on Uniform Traffic Control Devices which said, "A wider adoption of symbols in preference to word messages. . .is a desirable and important step toward the greater safety facilitation of traffic."[18] In spite of the policy, the change is slow.

The British Road Research Laboratory has recently completed an experiment with findings that bring out at least one of the characteristics that make the International roadway signs so useful. Comparisons were made of the long range recognition characteristics of British, U. S. and European signs. The results showed that the symbolic message carried by the European sign was legible at a considerably greater distance than either of the other two. The procedure and results are shown in Table 8.

The test included a comparison of sixteen sets of three signs each. The signs in each group were identical in their largest dimension and were supposed to have the same meaning; for example, British, European

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[17]"Report of Group of Experts on Road Signs and Signals, Second Session," 12 September 1951 (E/CN2/118), "Reports by Members of the Group of Experts on Road Signs and Signals on Studies and Tests Carried out Between the Second and Final Sessions," 23 June 1952 (E/CN.2/CONF 1/10); and "Final Report Submitted by the Group of Experts on Road Signs and Signals," 22 July 1952 (E/CN.2/119).

[18]U. S. Department of Commerce, p. 14.

TABLE 8

Long Range Recognition Characteristics of British, European and American Signs (other than Directional Signs)*

Mean Relative** Distance	British	European	American
a) Recognition of Sign Class	2.69	3.03	3.31
b) Identification of Particular Signs	1.00	1.15	0.93

*Source: R. L. Moore and A. W. Christie, "Research on Traffic Signs," British Road Research Laboratory paper prepared for the Engineering for Traffic Conference, July 1963.

**Distances are given relative to the mean distance for the complete identification of the British signs taken at 1.00.

and U. S. stop signs. The results showed that the class, or shape, of the U. S. signs could be recognized before those of either of the other two systems, but that the over-all advantage appeared to rest with the European standard due to the greater legibility distance of the meaning of the signs. This last point is obviously the more important of the two.

Assuming that the meaning of British signs was legible at a distance of just 100 feet, a driver would be able to see and understand a European sign twenty-two feet (115-93 = 22 feet) or about twenty per cent sooner, in time and distance, than its U. S. counterpart. With speed so important a factor in highway travel today, this characteristic cannot be overlooked.

Other bases for comparing the legends of U. S. and International sign standards are difficult to find since the basic design elements of each system have little in common--like attempting to compare apples and oranges. Rather than trying to conclude this chapter with a comparison of

the good and bad points of each, comments will be directed more toward the requirements of effective legends.

Brevity and clarity are the essentials. A short, meaningful word message is hard to write any time, but on signs it is a necessity--or it is liable not to be read. It must be written as if everyone in the city were a stranger (no local terms) and word order must be perfect to prevent confusion. Finally, the words must be made as legible as practicable by proper size lettering and, nearly as important, adequate spacing.

Symbols are governed by nearly the same rules as words. But where letters have been immune from obsolescence, symbols have not. Symbology based on any rapidly developing being or thing is liable to be obsolete very quickly. Bicycles have reached mature development; the steam locomotive had not. The first symbol will remain recognizable for a long time; the second is already outmoded. The power of a symbol may be great but it is subject to wide interpretation. Without complete indoctrination and acceptance by the public, it is useless.

The differences between the basic design elements of the U. S. and European systems obviously present obstacles to a universal standardization of traffic signs. But two facts compensate for any current difficulties. First, the gap is closing between certain areas of the two systems, and second, two standards provide more experience from which to draw examples and judge effectiveness.

Using both of these sign standards for examples, the next chapter explains in greater detail the design elements of each system and also injects examples of other effective traffic signs found throughout the world.

CHAPTER VII

CURRENT SIGNS AND SIGN SYSTEMS

This chapter illustrates and analyzes signs and sign systems in existence today. It includes examples of the devices which provide information and directions to the users of all forms of transportation commonly found in major cities. Each was chosen because it has proven effective. All use the principles, design requirements and features of signs discussed previously.

Road Signs.[1] Road signs are elements of the largest traffic control system in the world today. They are in fact the major part of the only system that has been standardized and generally accepted for use in controlling traffic throughout a country. No other sign systems studied were found to be used on a scale larger than a single city.

There are two major road sign systems in the world today. The first was originated and has been developed and used throughout Europe and many areas which are or have been under European control. It is called the International system. The second is the U. S. system which is used throughout most of North America and many parts of South and Central America.

The signs in both systems are grouped into three functional classes: (1) Regulatory signs have the authority of law and impose precise requirements. (2) Warning signs are used to inform road users of potentially hazardous roadway conditions or unusual traffic movements not readily apparent. They impose responsibility upon their users to employ caution.

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[1] "Road Signs" is a common term used to mean both highway and street signs.

(3) Guide signs are employed simply to inform road users of routes, destinations or other pertinent information.[2]

Though both systems cover the same traffic situations, their basic designs have little in common. Different colors are used in each to identify signs performing the same functions. The only similarity between shapes is the rectangle used to identify guide signs, and while the legends found on U. S. signs are primarily word messages, the International system used symbols almost exclusively.[3] This last difference has already been covered by discussion in Chapter VI. The main characteristics of each class of signs are shown in Tables 9 and 10.

In spite of their differences in appearance, both systems have proven effective in controlling traffic. Each shows a consistent use of color, shape and legend for nearly all signs.[4] The one difference which sets the two apart is the way in which the regulatory signs in the International system have been refined to differentiate between mandatory ("Do") and prohibitory ("Don't") commands. The first is identified by its blue background and the second by a red ring on its outer edges (Fig. 25). Two totally different regulations can be expressed by simply changing the color code of a single symbol.

Other considerations which show the capabilities of road signs and sign systems, and should be discussed here, have already been covered in previous chapters. They will not be repeated but only recalled in

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[2]Matson, Smith and Hurd, p. 307.

[3]Excluding guide signs which must use words and numbers to identify cities and provide general information.

[4]Inconsistencies will be discussed in Chapter IX.

Table 9

Classification of International and U. S. Sign Standards by Basic Shapes*

Class of Sign	Standard Shape	
	International	U. S.
1) Regulatory	Circular	Rectangular, Long Dimension Vertical
2) Warning	Triangular, Point Upward	Diamond
3) Guide	Rectangular	Rectangular, Long Dimension Horizontal

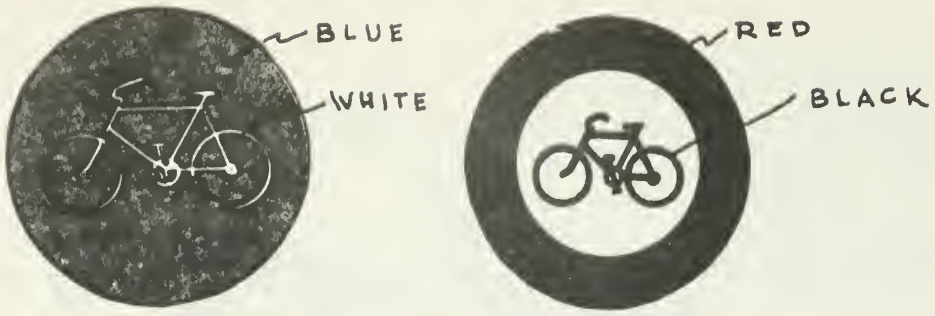
*Source: U. S. Department of Commerce, "A Comparison of the International Standard Road Signs with the United States Standard Road Signs." A report prepared by the Bureau of Public Roads for the U. N. Economic and Social Council, Transport and Communications Committee, January 1950.

Table 10

Classification of International and U. S. Sign Standards by Color Scheme*

Class of Sign	Standard Shape	
	International	U. S.
1) Regulatory	Prohibition: Red Band at Border, White or Yellow Background, Black or Dark Symbol Mandatory: Blue Background, White Symbol	White Background, Black Lettering or Symbol
2) Warning	Red Band at Border, White or Yellow Background, Black or Dark Symbol	Yellow Background, Black Lettering or Symbol
3) Guide	Variable, including White on Blue and Black on White	White Background, Black Lettering or Symbol

*Source: The same as for Table 9 above.



Mandatory Prohibitory

Fig. 25. Regulatory Signs in the International Sign System.

general terms. If properly used, road signs should (1) compel attention, (2) convey meaning at a glance, (3) allow adequate time for response and (4) command respect of users. Sign systems should be uniform in appearance and properly positioned, both for line of sight and for line of travel. If all these requirements have not been effectively filled by the systems now in existence, there is nowhere to turn for better examples except to new and original thinking.

Subway Signs. The signs found in both the Paris and London Subways are good examples of travel information that can and should be provided to users of public transportation. Both cities display diagrammatic maps of their complete subway systems in convenient and conspicuous locations throughout their stations (see Figure 26 for the map used in the Paris subway). Junction points of different lines are distinctly marked and explained so that users are able to determine where to transfer to other routes. In London the maps also code stations connecting with the British Railways. In Paris they list bus connections at the end of each line.

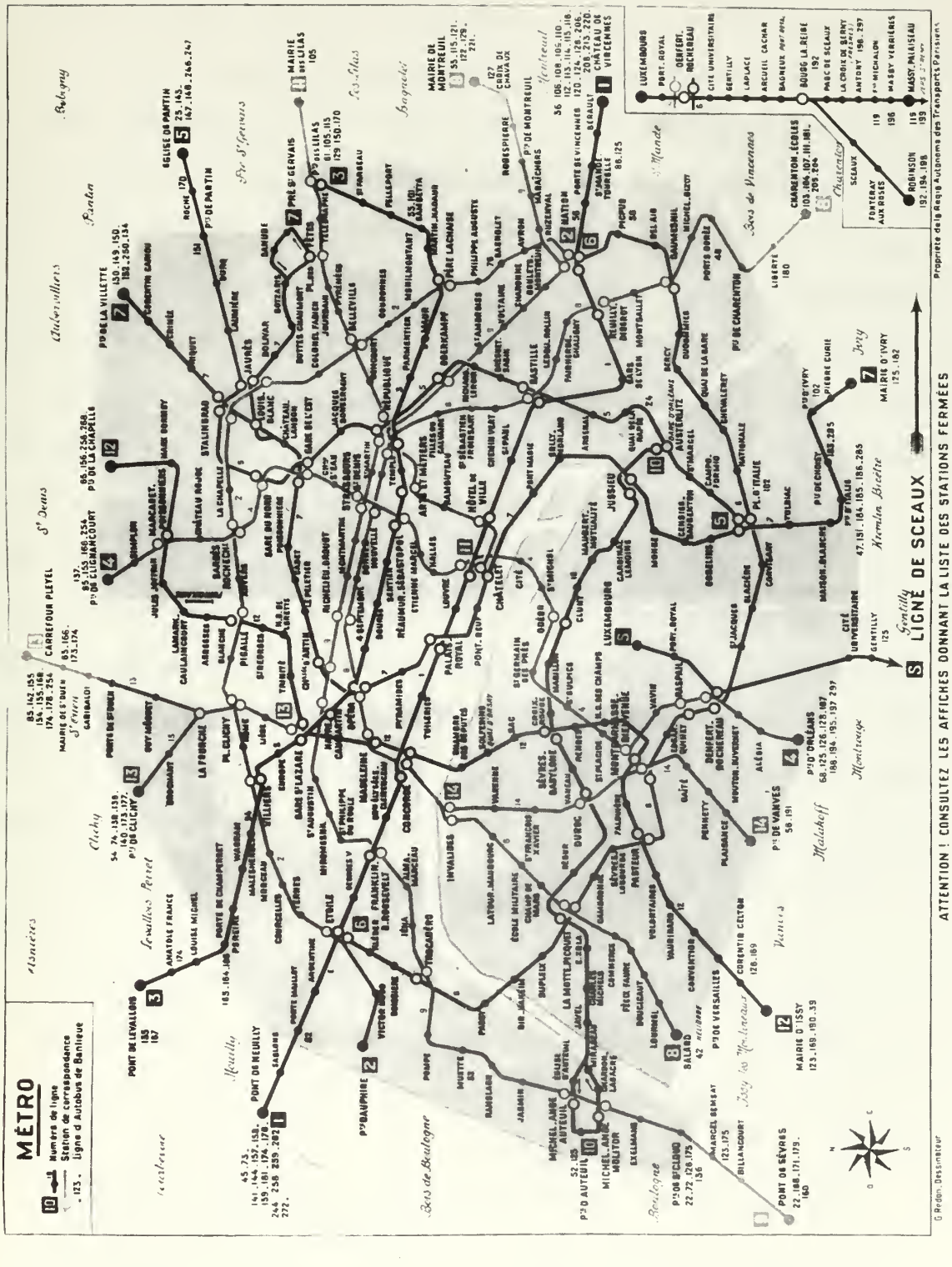

MÉTRO
Numéro de ligne
Station de correspondance
Ligne d'Autobus de Banlieue
ATTENTION ! CONSULTEZ LES AFFICHES DONNANT LA LISTE DES STATIONS FERMÉES
LIGNE DE SCEAUX
Propriété de la Regie Autonome des Transports Parisiens.
G. Rodon, Dessinateur

Fig. 26. Maps located in subway stations of the Paris "Metro." (Source: Paris et Sa Banlieue par le Métro et las Auto Bus, property of Regie Autonome des Transports Parisiens.)

Maps in both systems are printed in color. In Paris they are provided with this feature only to allow easier reading. Different colors are used for each route. On London maps, however, colored route lines have greater significance. The subway system is very complex, since tunnels may cross at the same point on three or four different levels.[5] In order to assist riders in identifying the proper point at which to transfer, station interiors are decorated in the color or colors corresponding to those of the lines shown on the subway maps. Wherever transfer between lines is possible, the colors assigned to each line are used. For example, a rider on a blue line route wishing to transfer to reach a destination found on a red route would be aided in knowing he had arrived at the transfer point by the appearance of a red color scheme and red lights. The color code scheme is then continued for the transferring passenger in corridors leading to the point of pickup of the new train. The colored lights are used where there are complex traffic patterns to attract attention to the proper direction to travel.[6] This feature is a unique service provided by the system. It reinforces the name signs and written information which are visible to the rider, posted on the platform and in the subway car.

London and Paris subway users are also provided with diagrams along the ceiling of the interior of the trains which show the stations and interchange points of the line on which they are riding (Fig. 27).

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[5]Subways in London are constructed deep in the ground, at one point reaching a depth of 250 feet.

[6]An example of the use of colored lights for this same purpose can be seen in the Grand Central subway station in New York City.

These are usually posted at regular intervals throughout the car and often at right angles to the sides so that a rider seated or standing anywhere in the car has access to a sign. Just as on the station platform, information necessary for travel is provided in a convenient and conspicuous manner. A traveller remains informed of his progress from arrival in the station until departure at the desired destination.

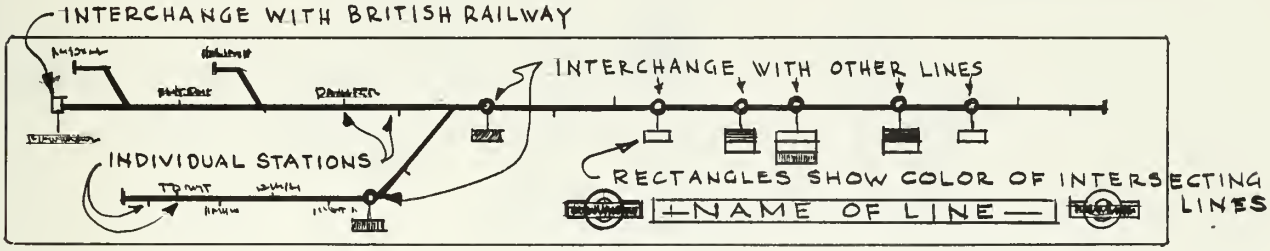

Fig. 27. Typical Schematic Diagram Found on Trains of the London Subway System.

Bus Signs. Travel information for bus users should provide the same continuity of information shown to exist in the best subway sign systems. Prospective passengers should be provided with route maps and an adequate means of identifying a desired bus. Riders should have information continuously at hand to keep them informed of trip progress, and departing passengers should be able to physically identify their stops. Both London and Paris can again provide the examples to illustrate systems fulfilling these requirements. Each city has designated or identified each route in its bus system by the use of numbers or letters. This coding is also displayed on the front of buses serving the routes and posted on route maps, or itineraries, located at the bus stops. Individuals waiting at pickup points can determine the line, intermediate points and destination of the bus route serving that location.

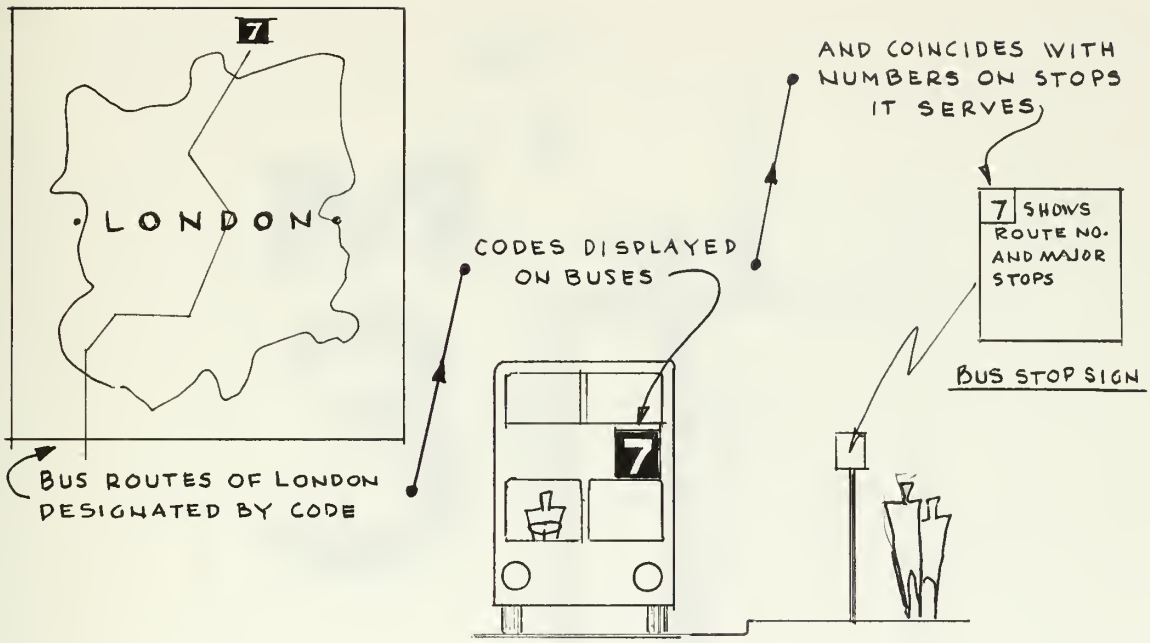
7
LONDON
BUS ROUTES OF LONDON DESIGNATED BY CODE
CODES DISPLAYED ON BUSES
AND COINCIDES WITH NUMBERS ON STOPS IT SERVES
7 SHOWS ROUTE NO. AND MAJOR STOPS
BUS STOP SIGN
7

Fig. 28. Identification System Used on London's Bus System.

Sign space at stops is often quite limited, sometimes being confined to the post holding the bus stop sign. For this reason, only major stopping points and destination of the route are incorporated in the signs, and then only in the direction of travel from the point of pickup. Signs showing the entire bus system are found at major points and at the origin and destination of most lines. The information available inside the buses generally parallels that found in the subways and therefore their description will not be repeated here.

The City of New York has recently adopted a bus sign map similar in concept but totally different in appearance from that found in either London or Paris (Fig. 29). The rectangular street pattern and simple bus route have allowed the map designer to produce an extremely effective device to aid bus travellers. Besides providing a full route itinerary and route identification code, it also incorporates the use of a north

arrow to assist in orienting the users.

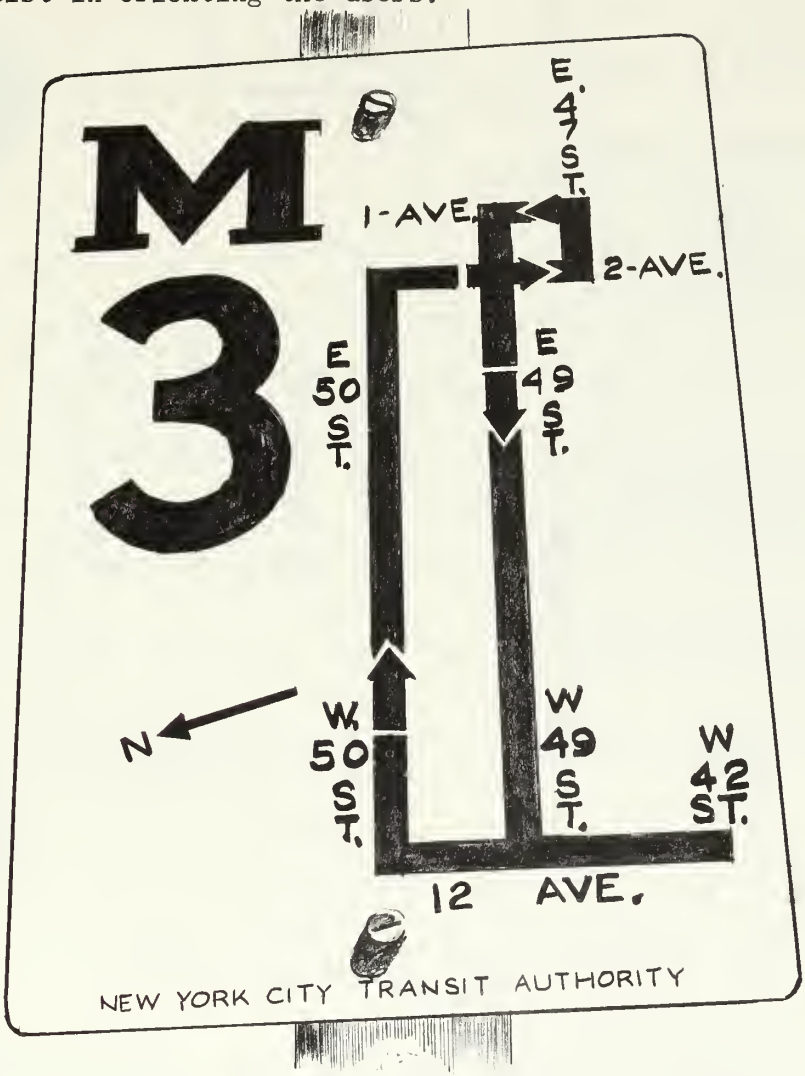

Fig. 29. New York City Transit Authority Diagrammatic Bus Sign (Courtesy of New York City Transit Authority, Brooklyn, New York).

The services provided by signs at bus stops do not end with just detailing information about the route. Obviously, they should identify the location as a bus stop and also inform the riding passenger of the name of the stop. In some cities this last function is performed by street name signs located close to and visible from an approaching bus. In Paris, one awkward appearing sign performs all three duties in a very effective manner (Fig. 30).

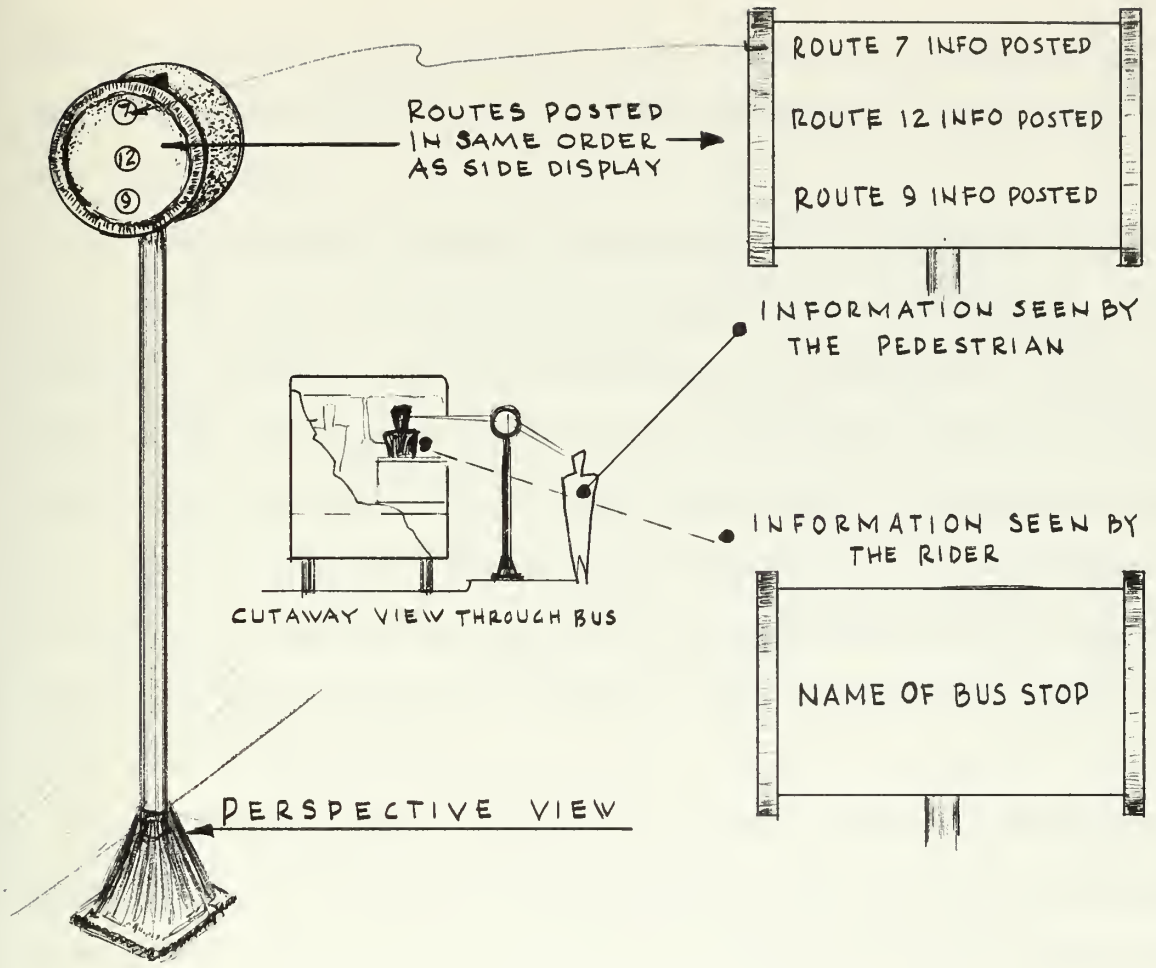
ROUTE 7 INFO POSTED
ROUTE 12 INFO POSTED
ROUTE 9 INFO POSTED
ROUTES POSTED IN SAME ORDER AS SIDE DISPLAY
INFORMATION SEEN BY THE PEDESTRIAN
INFORMATION SEEN BY THE RIDER
CUTAWAY VIEW THROUGH BUS
NAME OF BUS STOP
PERSPECTIVE VIEW

Fig. 30. Bus Stop Signs in Paris

Railroad Signs. There is little that can be said in this study about passenger traffic signing in American railroad stations. Research failed to provide any examples of particularly effective devices used to assist travellers find their way to and from trains. Perhaps one of the reasons is the lack of interest of many railroads in retaining passenger service on their lines.

In Japan, where over 15,000,000 passengers ride trains daily,[7] both the desire and the need exist to aid passenger movement. Close

[7] 15,369,000 passengers ride trains daily in Japan, according to the 1963 edition of Facts and Figures by the Japanese National Railways, October 1963.

schedules kept by the many suburban trains entering and leaving major cities make easy identification of each line very necessary. Color coding helps make this possible.

Trains serving a specific route have their exteriors painted with a particular color, or combination of colors, so that knowledgeable commuters entering a station can spot their train and go directly to it. This is always useful to the regular rider but not necessarily so for the stranger unless he is informed of the fact that color coding is being used. This can be done in a number of ways, but matching train and ticket colors is not enough. Additional identification must be provided either by notification by the ticket seller or by written notice conspicuously posted in the station and on the ticket.

Pedestrian Signs. The pedestrian's need for travel information begins the moment he leaves the bus, train, subway or automobile that has brought him to the city. His one source is usually the street name sign. The amount of information that can be put on a sign of this type is obviously limited by its size. But it can still carry the essential requirements for confident street travel. These are the street name, the block number, cross street name and directional information. This last item can be neatly incorporated by using it to support the first three. That is, no street name or block number should be used on a sign without identifying it with a north, south, east or west direction if this orientation fits the city street pattern. If it does not, then direction may be shown by the use of some north pointing indicator such as the north arrow device mounted on street name signs in Newark.

Even good street name signs are valueless to a pedestrian in unfamiliar surroundings if he has no base or reference on which to begin his travel. A driver uses a road map for this purpose, and bus and subway riders can use the maps shown in this study. But anyone who has emerged from a subway station in a strange city or part of town knows that there is little orientation value in simply knowing a street name. Which side of the street is the exit on? Which direction is it facing? What is its relative location in the block? Would leaving by another exit have been closer to the ultimate destination? All of these questions could have been answered before leaving the station by providing information through "You Are Here" maps similar in principle to those posted for reference and route information in subway stations. The major difference between the two would be the size of the area shown on the map and the detail provided. The pedestrian sign would concentrate on detailed information of the area immediately surrounding the station rather than providing a general schematic map of the entire city as shown on the route map.

One major city that currently provides such a pedestrian map is Stockholm, where large pictorial signs showing the cityscape in the immediate vicinity are placed in stations throughout its underground rail system (Fig. 31). They identify buildings, show exit locations and street names. The small arrowheads projecting from the circled numbers on the map indicate the actual direction of exit when reaching street level.

The problem of identification is reversed when the pedestrian is looking for public transportation. Entrances and pickup points at many subway and bus stop locations are poorly marked. Sometimes identification is inadequate and other times the entrances may be situated in unusual

Fig. 31. Pictorial Maps of Stockholm Located in Subway Stations. (Courtesy of AB Stockholms Spårvägar, Stockholm, Sweden.)

locations. The City of London has attempted to solve this problem by adopting standard identification signs which are placed, wherever practical, at subway entrances and bus stops. The symbol is distinctive enough to draw attention in the cluttered cityscape and yet pleasing enough to be used in the more rural suburbs. Devices used in West Berlin and Toronto for similar purposes are also included to show both the variety of forms used for identification and the importance some cities place on providing adequate identification of their public transportation (Fig. 32).

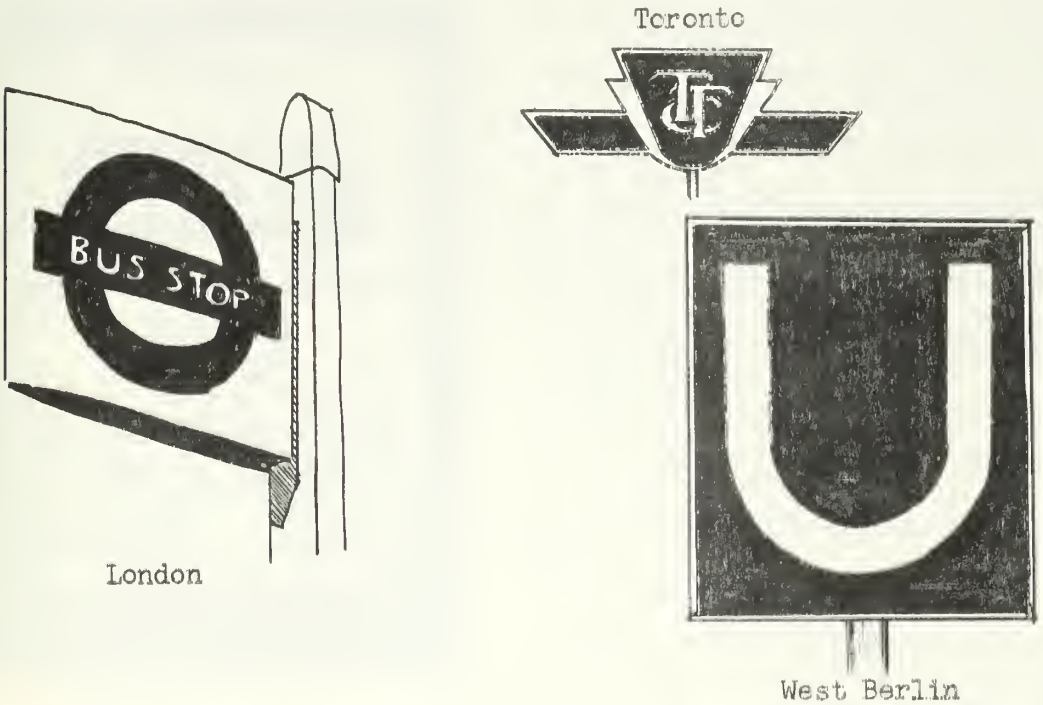

Fig. 32. Public Transportation Identification Signs in London, Toronto and West Berlin.

Miscellaneous. The remaining illustrations show methods adopted or under consideration for use in providing useful and informative traffic control.

Advance Street Name Signs. The City of Los Angeles is inaugurating a system of advance street name signs placed 100 to 150 feet in advance of the next cross street with 8" upper case and 6" lower case reflectorized letters. It will primarily serve automobile drivers by allowing them earlier notification of street locations so they can move safely to turning lanes. Studies[8] have shown that advance markers similarly placed to show route direction changes are valuable aids in promoting safety and efficiency in driving.

Stadiums. Shea Municipal Stadium in Flushing, New York is color coded to direct spectators to seat locations. Ticket colors coincide with general seat location colors. An even more complex system is used at the Los Angeles Dodgers baseball stadium where color coding extends to parking areas, so that spectators can park in locations close to their seats.

Fig. 33. New York City Taxi Cab Sign. (Source: City of New York Department of Traffic Annual Report 1962.)

Pictorial Signing. The City of Pittsburgh is currently using pictorial signs to identify, and indicate directions to, the city's Civic Arena and is contemplating introducing this device for other major traffic generators (Municipal Stadium and various business areas). The City of New York has adopted pictorial signs to designate both taxi (Fig. 33) and bus stops. The sign

[8] Lawrence D. Powers, "Advance Route Turn Markers on City Streets," Highway Research Board (Washington: NAS-NRC, 1962), pp.483-94.

acts both as an identifier to prospective customers and as a regulatory traffic sign.

Colored Roadways. Colored highway pavements are currently found in limited use in several countries of the world. No specifications for allowable use have been developed for the U. S., but the National Joint Committee on Uniform Traffic Control Devices presently has such a proposal under consideration. It would specify standards for use on the ramps both leaving and entering expressways. Fig. 34 shows an example of the proposed marking system. A blue surface is proposed for the roadway leaving the main route and yellow for the roadway merging with it.

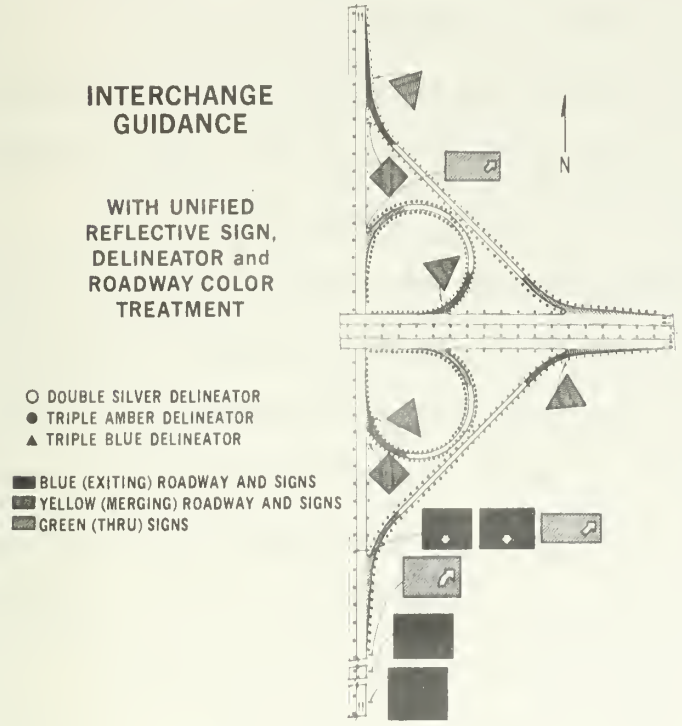
INTERCHANGE GUIDANCE
WITH UNIFIED REFLECTIVE SIGN, DELINEATOR and ROADWAY COLOR TREATMENT
O DOUBLE SILVER DELINEATOR
● TRIPLE AMBER DELINEATOR
▲ TRIPLE BLUE DELINEATOR
BLUE (EXITING) ROADWAY AND SIGNS
YELLOW (MERGING) ROADWAY AND SIGNS
GREEN (THRU) SIGNS
N

Fig. 34. A unified reflective sign, delineator and roadway color treatment showing order of presentation for northbound traffic through a typical interchange. Similar systems may be employed in a number of related traffic guidance applications. (Source: Minnesota Mining and Manufacturing Company, St. Paul, Minn.)

Conclusions. This chapter has presented a brief examination of sign systems, most of which have proven effective through years of use. Just how effective, it is impossible to determine.

The necessity to use foreign systems as illustrations of good public transportation leaves no doubt that a broad area for possible improvement exists in similar U. S. systems. Better signing could result by

merely adopting directly some of the schemes included in this chapter. But, as shown by the appearance of the bus map signs designed for New York City, individual study of the physical characteristics of the system concerned will produce better results.

No clear-cut superiority in either system of traffic signs was evident, but the International system has increased its ability to inform users by simply using a change of color with a standard symbol.

The cities of London, Paris and Stockholm have each undertaken to provide users of their transportation systems with more than a minimum amount of travel information. Stockholm, particularly in its subway stations, illustrates this characteristic by providing the pictorial maps already mentioned plus bus and subway time-tables and maps of the outer and inner city transit networks. This city has not forgotten that a traveller's final destination is not reached when he leaves the subway car. It provides him with additional travel information and thereby provides the continuity of information that is essential in any good city traffic control system.

The next chapter looks not at what has been done but rather at what might be done to increase the ease and safety with which travellers move.

CHAPTER VIII

NEW IDEAS FOR SIGNS AND THEIR SYSTEMS

If the technical details of sign construction and location have been properly fulfilled, then it appears that the usefulness of signs is wholly dependent on the ingenuity with which their basic features are exploited. Literature covering the field of traffic signing indicates that progress in finding better ways to present information to users is limited, and new approaches are non-existent. The National Joint Committee on Uniform Traffic Control Devices is slowly changing the U.S. Manual to include symbols found on International road signs.[1] Several major cities in the United States have incorporated the use of still others.[2] But because the highway sign system now found in Europe is all but completely developed,[3] it appears that when the American system had adopted whatever portion it considers useful, the process of change, at least major change, will stop. Rather than accept this perhaps overly pessimistic estimate of the situation, the following paragraphs introduce several variations to present

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[1] Parking area and pavement-width transition signs are two examples. The first uses a large letter "P", just as found in many European cities, but follows it with small letters "arking" only one fifth the size of the first letter. Eventually, these last, already ineffective letters should disappear.

[2] The City of New York is experimenting with the International "Do Not Enter" sign which consists of a red circle with a white horizontal bar across it. The City of Honolulu uses International roadway signs extensively.

[3] There has been little change in the basic symbols used on European highways since publication of the 1931 European Conference on Road Traffic in Geneva. (Based on study of sign systems found in article by Anthony Froshaug entitled "Roadside Traffic Signs," Design, No. 178, October 1963, pp. 37-50.)

thinking that perhaps could be adapted and refined for use in developing a better sign system and thereby provide more information and better orientation to its users.

In the field of City Planning, maps indicating the primary function of each part of the city (housing, industrial, business, etc.) are used as visual aids for both representing the existing conditions and determining the schemes for future land development. The functional areas are differentiated from one another usually by the use of a pattern or color code. Code-function relationships are not nationally standardized as yet, but the variations in use are so minor that official adoption will cause few changes in current practices. A recently published study which suggests a standard was prepared by the North Carolina section of the Southeast Chapter, American Institute of Planners.[4] Suggested land use classification and identifying code are listed in Table 11.

Examination of the land-use map of any large city will show that its functions are often intermingled. Except for parts of the urban area built up under zoning controls, there are usually no uniform or largely single-use areas. The result is that most cities have very complex, difficult-to-read maps. There are, however, general land-use maps which are coded into much larger and more generalized sectors. This is accomplished by determining the "character" of the area, similar to the way in which Wall Street is characterized as the financial district of

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[4] A Proposal for a Standardized Land-Use Classification System, prepared by the Land Use Classification Committee, North Carolina Section, Southeast Chapter, AIP, and published by the Division of Community Planning, Department of Conservation and Development State of North Carolina, Raleigh, N.C. (undated).

Table 11

Standard Land-Use Color Coding*

Classification	Explanation	Color
Transportation		
a) Vehicular	Routes and terminals for moving containers which convey passengers and/or freight by land, water, or air.	Medium Gray
b) Non-Vehicular	Routes, rights-of-way or easements for the transmission or pipelines for electricity, gas, etc. Also moving sidewalks and conveyor belts.	Light Gray
Production		
a) Extractive	Agriculture, mining, etc.	Burnt Ochre
b) Manufacturing	Durable goods and non-durable goods	Purple
c) Manufacturing services	Semi-tangible needs such as construction, storage buildings, welding shops.	Lavender
Business		
a) Retail	-	Scarlet Red
b) Wholesale	-	Magenta
Services	Supply general needs of an intangible nature to the public.	
a) Consumer	Personal, amusement and communication	Light Blue
b) Professional	Administrative, financial and advisory, research and testing	Aquamarine
c) Business	Repair, printing shops	Blue violet
Residence		
a) Single Family	-	Sand
b) Two-family	-	Yellow Ochre
c) Multi-family	-	Orange
Social and Cultural		
a) Personal development	Schools and universities, religious institutions, recreation	Apple Green
b) Health and welfare	Medical and Institutional	Peacock Green

*Adapted from information found in A Proposal for a Standardized Land-Use Classification System published by the Department of Conservation and Development, State of North Carolina (undated).

New York City. Other sectors of the City where similar work is carried on are lost in the generalization.

Land-use maps that have been generalized sufficiently to produce this imaginary homogeneity of function are fairly common. They are often used in articles and reports showing the long term movement or trends in a city's structure. Figure 35 is an adaptation of a map, from Greater Boston Business, in which the future land use of downtown Boston is represented. It details functions in generally the same way as suggested in Table 11 and illustrates the subject under discussion.

The possibilities of this idea in connection with sign uses are interesting. For a new arrival to a city, an opportunity to see a map combining generalized land use and major streets would provide a good orientation. Even though no specific definition were attached to the method of determining the boundaries of the generalized areas,[5] locating streets and particular points could be speeded by simply knowing the functional area where they were. In other words, even a code arbitrarily chosen would be helpful since it would immediately inform the user of the area of map on which to look. Businesses and theaters could even include the color of their area on letters and tickets to assist in orientation of visiting clients and customers.

Distinct color symbols alerting individuals of the use of this feature and providing valuable information might also be placed at

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[5] Any attempt to define generalized sectors by analytical means would seem impossible since the mental image and physical characteristic of a city seldom, if ever, match. In this case the impressions of a city based on the "mind's eye" seem to be a more valid basis for generalizing than does per cent of land use or other physical measuring device.

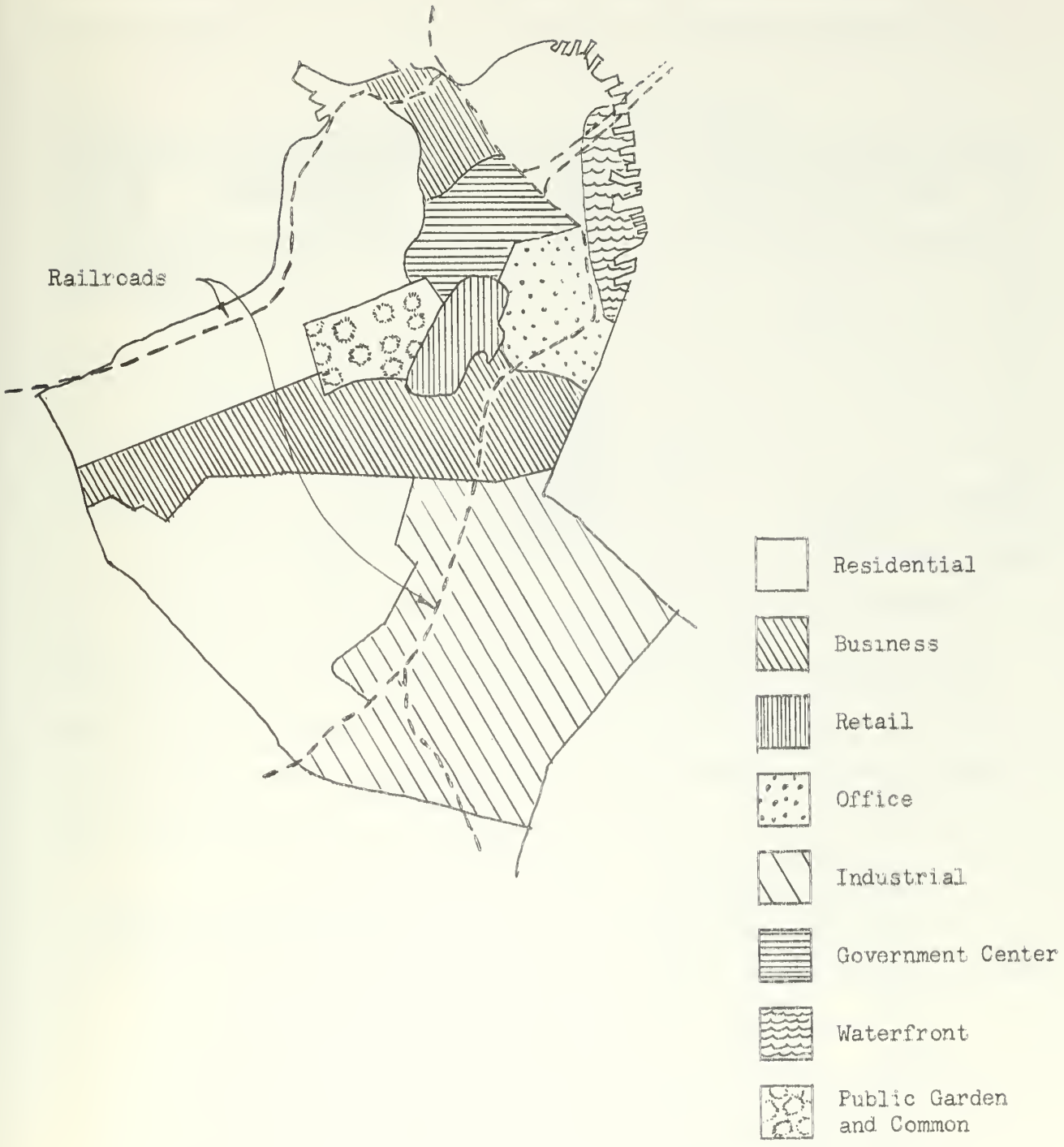

Fig. 35. Downtown Boston and Immediate Environs--Generalized Future Land Use

Source: Greater Boston Business, Boston Chamber of Commerce, Golden Anniversary Issue, Fall 1959, p. 21.

intersections of streets and in subways. These could show either the current location of, or indicate direction to, functional areas (Fig. 36).

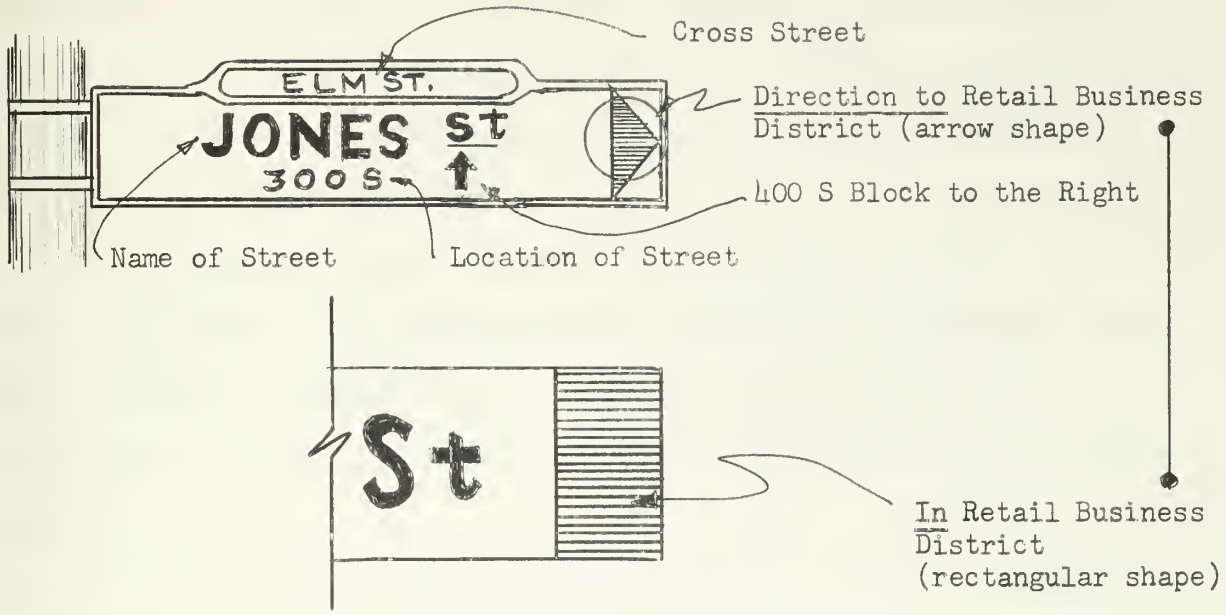

Fig. 36. A Street Sign Coded with Functional Area Information

This aid would be particularly valuable on expressways to identify turn-offs that lead directly to primary districts. A relatively small coding device, which could be incorporated into signs similar to those now being used, would be all that was necessary to add this convenience (Fig. 37).

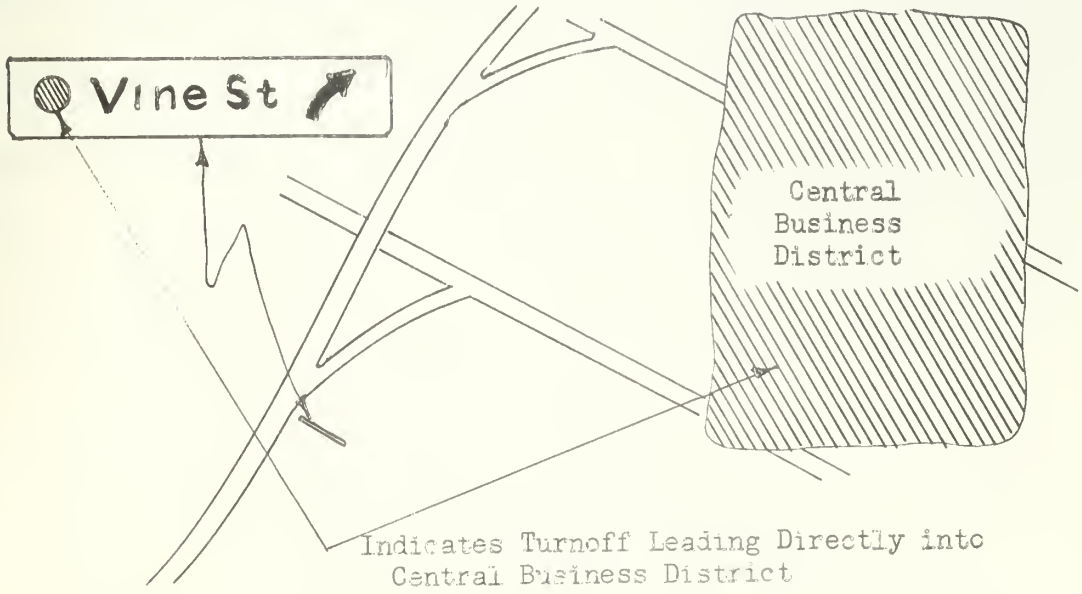

Fig. 37. Functional Area Information on Expressway Signs.

With this system the role of color would finally become tied to a physical location within any and every city of any real size. As for the current use of color in buildings and stadiums to direct pedestrians, or in subways to designate routes, it does not appear that any damaging effects would occur to either method of identification by continuing to use both of them simultaneously.

The feature of signs most susceptible to change is legend. The usable and distinct variations possible in language are innumerable compared with color and shape. But, as mentioned earlier, most changes are now confined to adopting or modifying current International traffic sign characters.

There are other sources from which to develop an international sign language. The one most discussed is Esparanto, which could be used world-wide. But it has already been determined, as described in Chapter VI, that symbolic signs are recognized at greater distances, and since distance is both a safety and convenience factor, a universal word language would do little to solve sign problems.

There are also a number of symbolic languages which have been developed and could possibly have some application. The best known but most limited language is called Isotype. It was developed by Otto Neurath[6] and is used in education, business, advertising and on traffic devices to depict such things as ships, men and cars (Fig. 38). It is wholly pictorial and its scope is based on the following philosophy:

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[6]Isotype Institute, 68 Oxford Street, London W1, England.

"Frequently it is very hard to say in words what is clear straight away to the eye. It is unnecessary to say in words what we are able to make clear by pictures."[7]

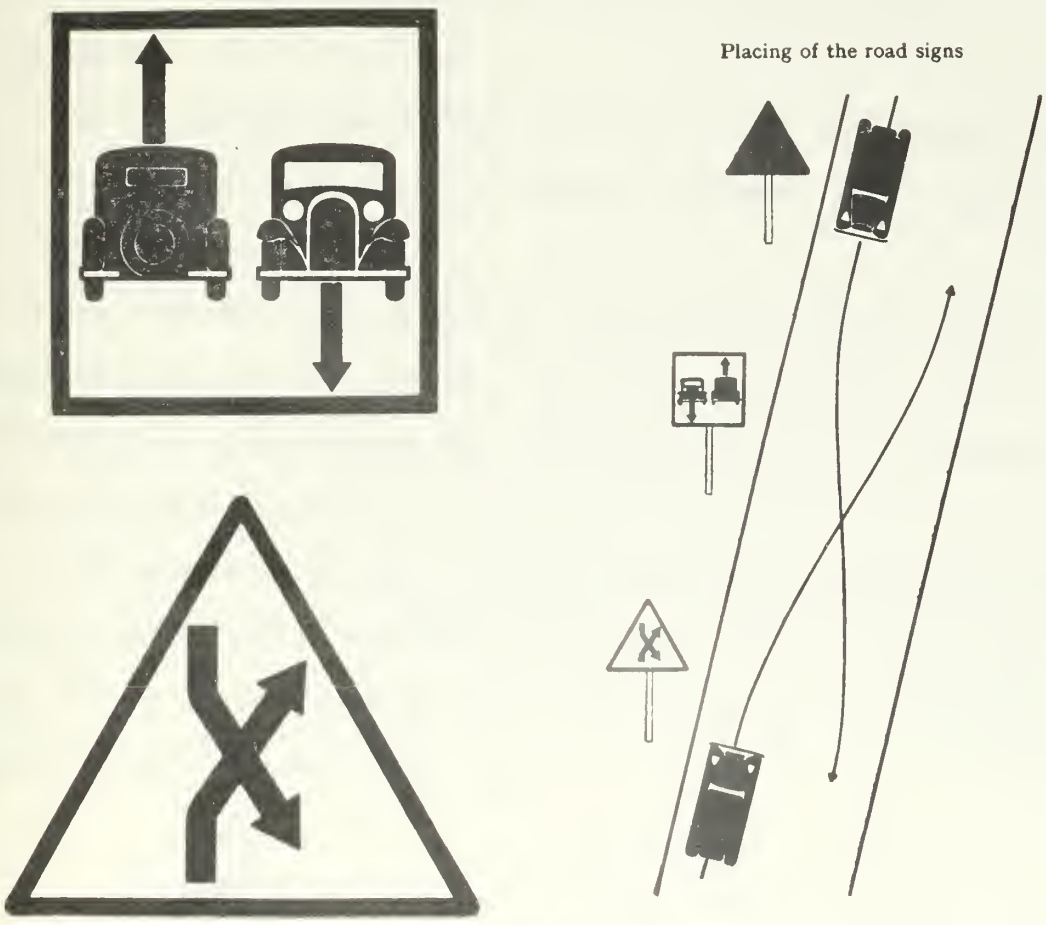

Fig. 38. Isotype Pictures Used for Road Signs to Inform Drivers to Switch Driving Lanes.

The chief points, or perhaps limitations, of the Isotype system are described by Mr. Neurath as follows:

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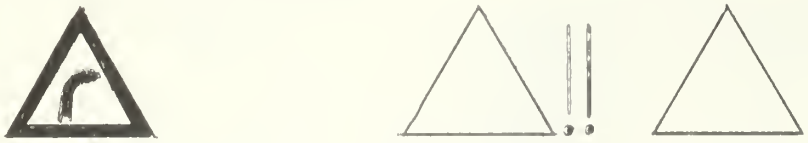
[7]Otto Neurath, International Picture Language (London: Basic English Publishing Co.), pp. 26-7.

"A picture which makes good use of the system gives all the important facts in the statement it is picturing. At the first look you see the most important points, at the second, the less important points, at the third, the details, at the fourth, nothing more--if you see more, the teaching-picture is bad."[8]

It is apparent that Isotype could not provide the new idea necessary to revolutionize the legend of signs. The symbols used would have to be more universal.

At least two existing symbolic languages lay claim to being complete and universally adaptable. The first, called Safo, has been developed by Dr. Andre Eckhardt.[9] The second, known as Semantography, was invented by C. K. Bliss.[10]

The work of C. K. Bliss is particularly interesting because he has developed traffic signs, including their shapes, with his language.[11] The similarity of Semantography sign shapes to those already existing on highways is worth further discussion.



Warning — International Road Sign

Danger, Beware — Creation Nature — Semantography Symbol

Fig. 39. Comparing a Current Road Sign Shape to a Symbol in the Language of Semantography

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[8] Ibid., p. 27.

[9] Dr. Eckhardt is located in Bavaria, Germany, 33 Possenhofener-strass, Starnberg/See.

[10] Bliss Institute, 2 Vicar Street, Coogee, Sydney, N.S.W., Australia.

[11] C. K. Bliss, Semantography, Vol. II (Yellow Springs, Ohio: Semantography Publishing Co.).

Three examples are used to show the derivation and meaning of Bliss sign shapes. The International road sign for warning, or safety, is a triangle. Semantography uses the triangle to mean creation, creature, or nature. The addition of an exclamation mark following the sybmol means danger, or beware. If this language were a universal standard, a triangular shaped traffic sign would carry a deeper meaning than now exists. The driver seeing it would not just recognize the sign because of a distinctive shape; he would "read" the shape as meaning Danger!, Beware!, to all forms of creation. The derivations of other sign shapes follow similar reasoning. The danger sign, which is similar to the International stop sign,[12] and the square shape for mandatory compliance, which approximates the shape of the U. S. regulatory signs, are shown in Fig. 40.

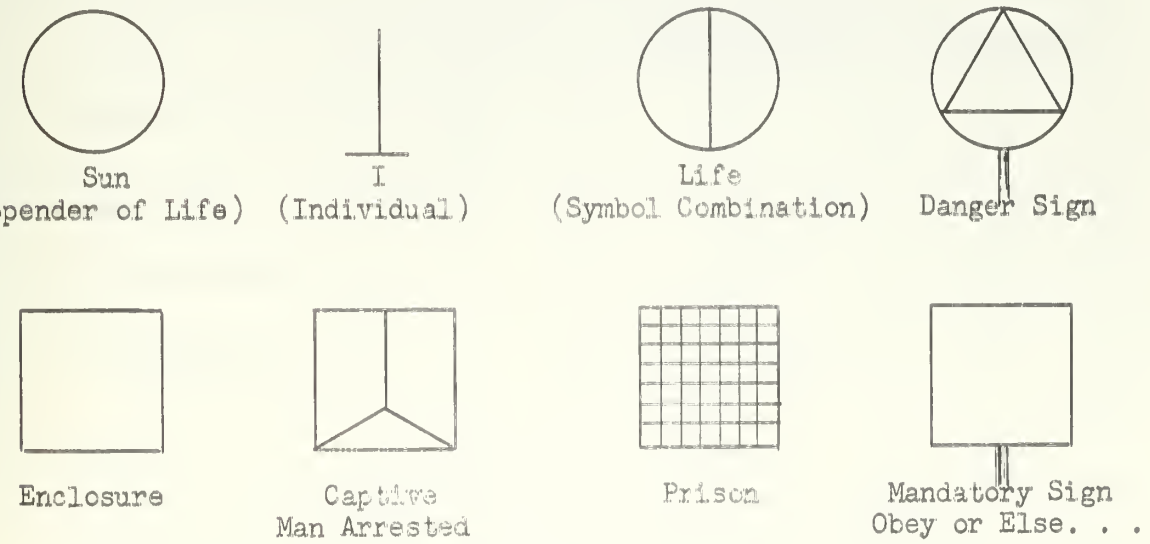

Fig. 40. Derivation of Road Sign Shapes (Circle and Square) Using Symbols Found in the Language of Semantography

[12]The Triangle is inverted in the International Stop Sign.

The traffic sign shapes that would be used based on this symbolic standard are therefore similar in some respects to those found in both of the current road sign systems. The reasoning used in their derivation obviously appears weak because it has no real meaning to anyone but an advocate of Semantography. The one perhaps useful item developing from this discussion would be the increased clarity of a sign system that used the additional distinctive shape suggested by Semantography. Table 12 compares the basic sign outlines of the U. S. and International standards plus a composite, originated to take advantage of the increased clarity of a new shape.

Table 12

A Comparison of Basic Sign Shapes
in the U. S., International and Composite Standards

Class	Sign Shapes		
	U. S.	International	Composite
1. Warning	◇	△	△
2. Regulatory	□		
a) Prohibitive		RED	○
b) Mandatory		BLUE	□
3. Guide	▭	▭	▭

A new sign legend incorporating the symbols of Semantography would rely on the arrow even more than would the current standards. Figure 41 illustrates some of the Bliss recommendations.

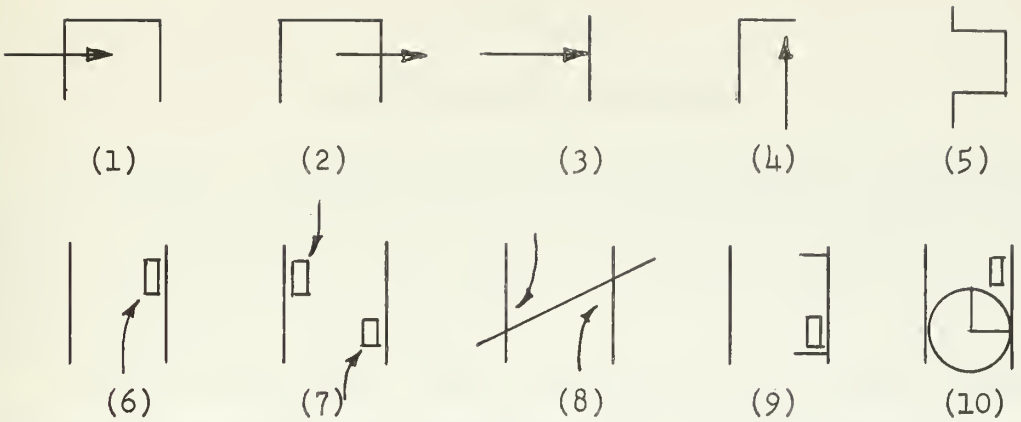

Fig. 41. Illustrations of the Possible Uses of Semantography on Traffic Signs: (1) Entrance, (2) Exit, (3) Stop, (4) Keep Right, (5) Dead End (displayed at right angles to Dead End Road Entrance), (6) Parallel Parking on Right Side, (7) Parallel Parking Both Sides, (8) No Parking Either Side, (9) Parking Between Signs (other sign ahead, assuming driving on right/side of road), (10) Parking Time Limit (details given on explanatory sign below).

(Source: C. K. Bliss, Semantography, Vol. II [Yellow Springs, Ohio: Semantography Publishing Company].)

The examples shown obviously present designs not found on road signs today. Some are very descriptive and bear further study. But evaluation of their possibilities for use is outside the scope of this study. The important point to be made is that there are other avenues to consider when designing the signs which are used to inform and regulate.

The suggestions in this chapter represent the results of research into changes that would greatly affect the features of signs and their use in a system. Coupled with ideas developed and discussed in previous chapters, and the practical background provided by interviews and correspondence with traffic engineers, city officials and interested individuals, the next chapter consolidates and concludes this study by suggesting the form and features that a sign system should have to effectively inform and direct travellers.

CHAPTER IX

A CITY TRAFFIC SIGN SYSTEM

A system is normally defined by stated principles and/or physical objects. In either case, the intent is to arrange the essentials in a rational dependence or connection.[1]

In the introductory chapter the contention was made that traffic sign systems found in cities are inadequate, providing only the automobile driver with any form of coherent and consistent signs, and overlooking--at least relatively--the needs of other types of travellers, the pedestrian and public transportation rider, and particularly the stranger among them.

The major part of this thesis, then, has been devoted to both discussing the principles of a traffic sign system and developing the physical objects that might be used in it, a system which could properly regulate movement and provide information to the users of all forms of transportation commonly found in large cities.

The methods used to develop the results found in this chapter have been by the examination of practical examples, experimental results and theoretical considerations of subjects applicable to signs. In the shortest possible terms, the system consists of:

(1) A subsystem of standard highway signs.

(2) A subsystem of standard identification signs for public transportation facilities.

(3) Continuity of information in all forms of travel.

Standard Highway Signs. W. G. Gallie writes that three aspects must be clear in a system of highway signs: The meaning of signs (semantics),

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[1] Webster's New Collegiate Dictionary, 2nd Edition.

the coherence of the sign within some structured system (syntactics), and the results of the signs in terms of action (pragmatics).[2] Actually, these requirements are applicable to the sign needs of all three forms of city transportation being studied, but the primary difference in their application here lies in the speed with which the automobile driver must comprehend meaning and take action. The element of speed requires that signs found on roadways be the most standardized of any found in a city sign system. They must be uniform in appearance and location. But at the same time each class (regulatory, warning and guide) must be as different from the others as practical shape and color will allow. Even with these characteristics, traffic signs on city streets must be given special consideration as a result of the problems of sign congestion.

The number of signs necessary to adequately inform people increases as the speed of travel decreases. In cities, where speed is slowed by traffic and other delays, streets must contain more signs than high speed expressways. There are also more things to identify within cities, and more that need to be identified. These couple together to produce a poor environment in which to place signs requiring mandatory action or providing needed information. Two means of overcoming the problems produced by the environment are by the institution of a more uniform but distinctive road sign standard and by increasing the standardization of sign location. The problem in cities is to distinguish the signs which inform and instruct from those which offer goods and services.

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[2]W. G. Gallie, Pierce and Pragmatism (Harmondsworth, 1957).

(a) Distinctive Signs. The results of experiments on shape, color and lettering of highway signs in both Europe and the United States are generally in agreement. The order of color visibility for both city and country driving, from best to worst, is yellow, white, red, blue, green, and black. The shapes most easily recognized include the square or "diamond," the circle, triangle and rectangle, in about that order. Letter shapes and sizes adopted for use on signs in both Europe and the United States are also comparable, even in the use of the sometimes controversial lower case letters. Both the U. S. and International sign standards have incorporated in them many of the features shown above to be the most effective. Yet each has many features, both good and bad, not found in the other. Those considered in determining the shapes and colors for the new sign standard are mentioned in the succeeding paragraphs.

The standard developed is based primarily on U. S. signs, two exceptions being, first, the use of the idea found in the International regulatory signs whereby mandatory and prohibitory requirements are separated by color, and second, the introduction of a round sign shape. The circular shape and color differentiation are, in fact, the key to the uniformity and distinctiveness mentioned as essential to overcoming the poor city environment. Before illustrating the new standard, a brief description is given of each U. S. sign used, with particular attention given to the inconsistencies in their current standardization.

Existing regulatory signs in the U. S. system are rectangular in shape and colored black on white. There is no distinguishing feature used to differentiate between mandatory and prohibitory requirements. There are also several exceptions to both shape and color standards (Fig. 42). The

standard shape and color (black & white)

wrong shape and color (yellow)

wrong color (red & white)

wrong shape and color (red)

wrong shape

Fig. 42. Exceptions to the Shape and Color Code of Regulatory Signs in the U. S. Highway Standards.

octagon, vertical and horizontal rectangles, and triangle shapes are included. Yellow, red and green colors are used besides the standard black and white. The new system divides the signs in somewhat the same way as does the International system but adds both a color and a new shape to the class to increase its usefulness.

Warning signs on American highways are both "diamond" shapes (a square tilted on end) and round (for railroad crossings). The use of yellow for this class is particularly appropriate. The color already has great significance in traffic control since it is used on stop lights as a cautionary sign. It also has high visibility characteristics, better than any other color, day or night, according to experimental results already shown. The color would seem to set it apart somewhat more than would the color red, which is used for two sign classes in Europe,

namely warning and mandatory regulations.

The third class, the guide or information sign, is the least standard of the three. Travelling from state to state in the United States, it is not unusual to find blue, green, white, red and even brown guide signs. International standards call for blue and white or black and white, but in this country green and white seems to be developing into more of a standard than any other colors. Its use seems logical. In the city it would contrast well with the denuded surroundings, and in the country it would harmonize and yet remain conspicuous, since the signs it was used on would be large, to meet automobile speed requirements.

Using these criteria, the divided regulatory class, yellow warning signs, and a standard guide sign color, the results shown in Table 13 are recommended as a new U. S. Sign Standard.

Changes as recommended in the Table are based on a number of considerations already partly discussed. First, an individual shape for railroad crossing warning signs seems unwarranted. Deleting this sign would mean that its functions would be transferred to the "diamond" warning sign, probably using the same symbology. Second, the octagonal stop sign, which is probably the "sacred cow" of the U. S. Highway sign standard, has the poorest discrimination value of any shape currently used on the American highways.[3] Why not retain the color, modify the shape slightly to a circle and place it into, rather than apart from, a system?

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[3]A. R. Laner, "Certain Structural Components of Letters for Improving the Efficiency of the Stop Sign," Highway Research Board Proceedings of the 27th Annual Meeting (Washington, D. C., National Research Councils, 1948), Table 8, p. 369.

Table 13

Recommended Standard for U. S. Street and Highway Signs

CURRENT ↓ / Proposed →	Regulatory		Warning	Guide
	Positive	Negative		
REGULATORY	(a) STOP → Becomes			
	Remains			
	(b) Abolished			
	YIELD → Remains			
WARNING	(c) R → Abolished			
	Remains			
GUIDE	Remains			
New Basic Color	White	Red	Yellow	Green
Color of Letters/Symbols	Black	Black and White	Black	White

Notes: (a) Stop Sign becomes round; (b) Horizontal Rectangle no longer used as Regulatory Sign; (c) Round Railroad Sign abolished. Symbol placed on Warning Sign shape.

The deletion of the horizontal rectangle from the regulatory class is a recommendation that should present little difficulty in effecting. The exception as shown on Table 13 was caused by a single

Exception New Design

Fig. 43. Alternative "One Way" Signs

sign, the one-way marker, which is already an alternative design and could be removed from the Manual as a recommended sign shape.

The "Yield" sign is the one exception to the system as proposed. Due to its apparent acceptance and success in both the International and U. S. systems, its use has been retained.

The most important feature that this recommended standard introduces is a new color and shape which cover some of the most hazardous problems in urban driving. "No Turn" and "No Entry" situations on city streets seem to be very difficult regulations to present effectively to drivers. The tendency to want to continue on a desired route takes an especially strong sign stimulus to overcome.[4] The new sign, which is very distinctive, might be able to provide it. Their appearance, as

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[4] Matson, Smith and Hurd, Traffic Engineering, p. 24.

shown in Fig. 44, is identical to the International sign standard.

No Movement No Turn No U Turn No Entry No Parking

Fig. 44. A New Class of "No" Regulations.

The use of this class is intended for conditions that are unalterable requirements. For example, it would be used for a "No Parking" sign only where parking was illegal at all times. Limited or regulated parking would still be designated by the rectangular regulatory sign. The differentiation will permit a more rapid evaluation of parking circumstances than now exists. Current color codes differentiate parking regulations as follows:

> "Where parking is prohibited at all times or at specified times, parking signs shall have red letters and border on a white background (Parking Prohibition signs); and where only limited-time parking is permitted, or where parking is permitted only in a particular manner, the signs shall have green letters and borders (Parking Restriction signs)."[5]

(b) Standard locations. A greater standardization of sign location and color would have three major advantages over the existing situation. First, the individual looking for a sign would have a frame of

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[5] U. S. Department of Commerce, p. 47.

reference. Second, traffic officials would have more assurance that essential signs were likely to be seen. Third, the size of signs could be reduced because conspicuous location could partly make up for conspicuous dimensions.

Consistent locations are already quite common for regulatory and warning signs. This has been accomplished by specifying the required location on the street and leaving the actual posting problem to the city engineer. Where a pole which can be used to fulfill the requirement is not already in place, one is installed.

Instructions for the locations of guide signs which provide destinations, distances and other information are still too general. The Manual states that ". . .signs may be erected on the far right hand corner of the intersection."[6] More stringent requirements paralleling those of the other two classes of signs should be adopted. Just as advance warning signs are provided to increase alertness well in advance of the location of the actual sign marking a hazard, a similar requirement should be placed on the posting of important destination signs. If a destination sign is important enough to be installed several hundred feet in advance of an intersection, then it should be repeated at the actual turn in an accessible location to both drivers and pedestrians.

Broader Use of Standard Traffic Signs. By introducing greater conformity and color contrast into traffic signs, the possibility for their use as effective control devices in the broader context of traffic defined in Chapter I seems logical. Yellow diamond-shaped warning signs could very well be used to identify dangerous locations on sidewalks where repairs were

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[6] Ibid., p. 97.

in progress. One-way subway turnstiles could be more easily identified by the use of "One-way only" regulatory signs on the approaching side and a red and white circular "No-entry" sign on the other (Fig. 45). Commuter

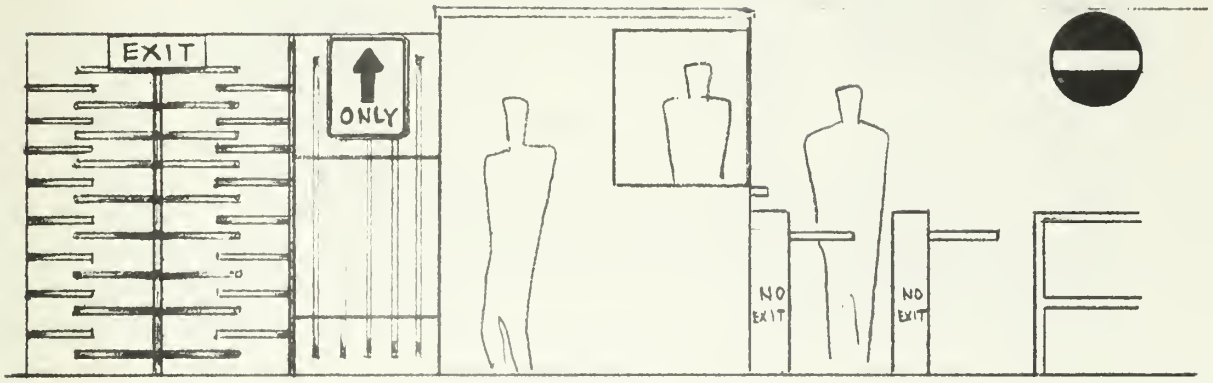

Fig. 45. The Use of Standard Traffic Signs in a Subway Station.

trains could display the same no-entry device above entrances to railroad cars as an indicator that all seats were filled. Even private entrances in commercial buildings could be marked with this symbol.

The shape and color of guide signs could also be used more effectively. Even though the information signs located in subway or bus stations would seldom be shaped like the standard horizontal rectangle used on streets and highways, this shape could be used as an identifying mark, say at the top of the sign, or displayed close by. It could convey to the traveller the fact that information about the city was readily available. Each of the sign classes might in this way be pressed into use for other types of city transportation and thereby increase the familiarity of their meaning for use on highways.

Standard Identification Signs for Public Transportation Facilities. Table 14 lists the features of bus stop signs found in several major cities in the United States. Their lack of similarity is obvious. A traveller moving between any two of these cities does not even have the advantage of knowing what to look for in the way of a sign, or other device, to identify the location of a bus stop or subway entrance. A standard sign found at all transportation pickup points in cities would be a useful addition to

Table 14

Bus Stop Identification Signs
in Various Cities in the United States*

City	Description of Bus Stop Sign
Chicago	Cream and Green Rectangle with Route Numbers and Stops
Cleveland	Diamond-Shaped in Various Colors
Miami	Green on Yellow Rectangle
Milwaukee	30" x 5-1/2" Blue and White
St. Louis	4" x 12" Black and White Signs with Blue Route Numbers
San Francisco	Sign or Yellow Band on Nearby Pole Sometimes Used
Seattle	12" x 18" Yellow Sign

*Source: Compiled from data received in questionnaire submitted as part of this study to major U. S. cities.

the cityscape. It would provide rapid identification for anyone, local or traveller, and, if properly designed, would do it in a pleasing manner. The design should consist of a single basic color for all forms of transportation, for reasons to be discussed later. A differentiation between bus, train, subway, and even taxi would be by a distinctive symbol or

letter. Examples of a simple but effective design are shown in Figure 46.

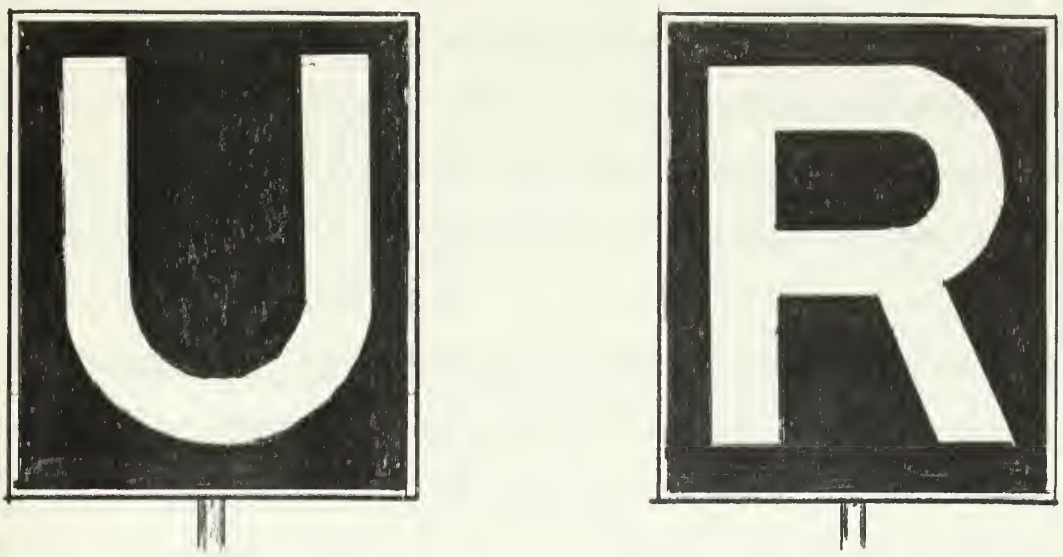

Fig. 46. Standard Shape and Color Devices for Identifying Public Transportation Stations. Blue Background and White Lettering.

More meaningful letters might be found than either of those shown, but both seem to have wide acceptance appeal. Subways are commonly referred to in Europe as "The Underground." The Berlin system is known as the U-Bahn (its sign was the basis for the "U" example shown in Fig. 46). Even the shape of the letter has a certain psychological significance, seeming to dip underground, as is characteristic of subways. Similarly, "R" is a familiar letter in the abbreviation for railroad (RR).

Sign sizes would necessarily vary between each type of transportation and even from city to city. The latter variation, however, should not be entirely arbitrary but kept within a certain range in which maximum visibility remained the key consideration.

The blue color suggested for this sign and its distinctive shape and symbols would also be used as a device to attract attention to

information pertaining to transportation facilities, routes or schedules. The green guide signs mentioned earlier would provide directional information to destinations in the city. The signs marked with blue would pertain to transportation information, including directions to closest interconnecting facilities, maps of subway routes, bus lines, and other schedules. Similarly, on street information signs any reference to directions to railroad stations or bus stations would have a blue background and stand out from other basically green signs.

Continuity of Information on All Traffic Routes. A good traffic sign system must provide continuous service in two important ways: It must be usable twenty-four hours a day and insure that those using the system will have continuous contact with the information necessary to complete their trip. A more liberal and strategic use of maps, route designators and schedules, plus adequate identification of route and conveyances, are the essentials to providing the continuity necessary for easy travelling.

(a) Maps, Diagrams and Directions. Every major transportation terminal should have large maps showing major streets and landmarks, including important functional districts shown in color. These could include the Central Business District, principal streets, landmarks and transportation facilities, large public parks, or other areas for which the particular city is noted. The near standard color code already used on land-use maps by planners to differentiate between functional districts of cities is probably adequate for this use as it now stands. Other more local orientation maps--similar to those shown as now existing in Stockholm (Fig. 31)--should be posted in subway stations and at major bus stops. The use of arrows, as shown on the map, is a particularly effective device for orientation.

Even individual exits of subway, train and bus terminals should be posted with a better form of information than is now found. Street exit signs in subways could easily be made to provide more information by adding the names of adjacent intersecting streets (Fig. 47). The large, often confusing bus and train stations should be posted at each exit with similar but more elaborate diagrams showing the street pattern in the immediate vicinity and the location of the interconnecting transportation facilities (Fig. 48). This final orientation would reinforce the information received from the city-wide map, if it has been used, and prepare the stranger for the unfamiliar surroundings immediately outside.

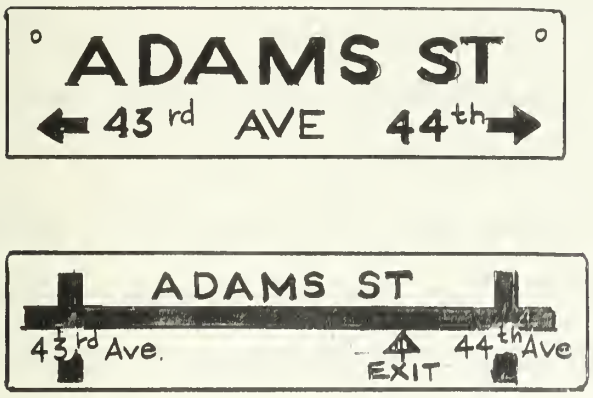

Fig. 47. Street Exit Signs for Subway Stations.

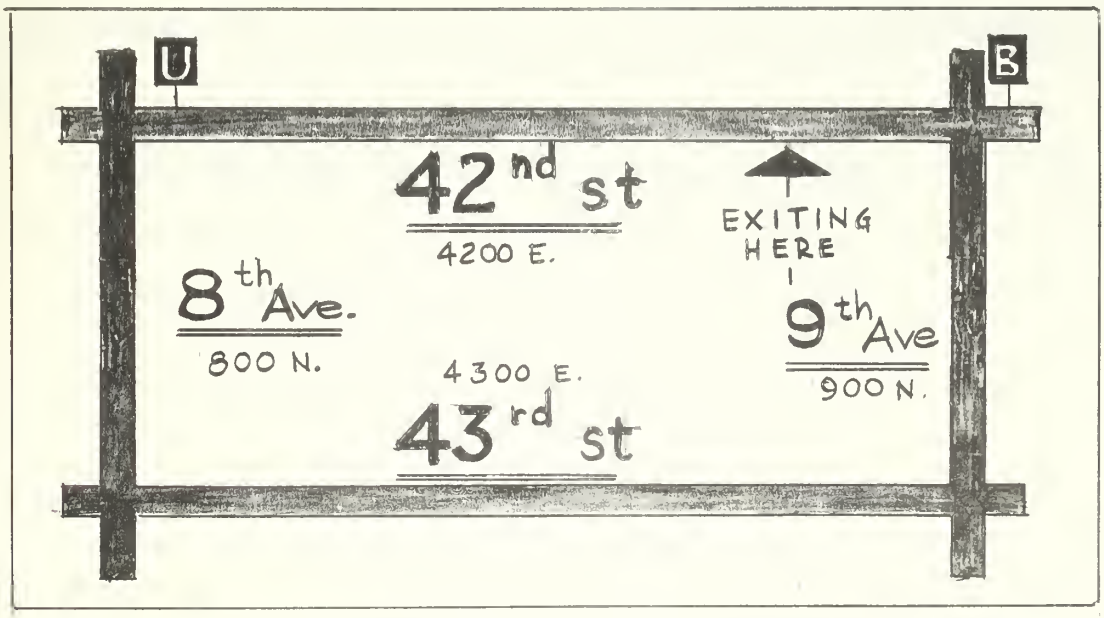

Fig. 48. Street Exit Signs for Large Transportation Centers Showing Street Pattern and Interconnecting Transportation in the Immediate Vicinity.

(b) Route Designators and Schedules. Diagrams displaying routes followed by buses, commuter trains or subways should be posted in their respective stations or stops from origin to destination. Identical information such as that shown previously in Figure 27 should also be placed on the conveyances. Where space for display is limited, as might be the case at bus stops, an abbreviated route map showing only stops from point of pickup to destination seems adequate.

Route maps should also indicate both transfer points with other lines in its system plus other forms of transportation. An example of the latter suggestion was seen on the Parisian subway map (Fig. 26) where connecting bus routes were indicated. Even intra-city connection points might be included. A subway map could show both train and bus-crossing points, bus maps the train and subway stations along the line, and so forth. For maximum orientation to users, the route maps found in bus, train or subway stations should be identical in form. Variations would exist only in the emphasis placed on a particular type of transportation through intensification of the color of its route lines or a special supplementary information sheet.

(c) Adequate Identification of Route and Conveyances. The last requirement for adequate travel continuity is the one most essential to insure its success. Without adequate identification of both the name of stations and the arriving bus, train or subway, all of the information gained through route maps, signs and schedules is useless.

The names of subway stations must be posted continuously along their full lengths, and in conspicuous locations. The view from any position inside the train should show a station name visible to both a seated

and standing person. Color can be a very useful code in identifying particularly important stations, such as interchange points, but trying to attach a color significance to every station would be impractical and a necessarily limited convenience. Subway facilities vary from city to city, probably making no two systems alike. The only practical use of color on subway cars which would have universal application seems to be its use to differentiate between local and express service. The identification of trains seems best done by the use of numbers or a letter-number combination. The shorter the identification used, the easier the method of display, recognition and ability to remember.

Bus stop identification requirements are similar to those needed for subways. Numbers again seem to be the most effective means to designate routes. As in subway stations, the name of the stop should be visible to passengers. Bus stop locations are seldom identified by name other than by street name signs that might be located close by. The suggestion of this study is that the street name location of the stop be included as an integral part of bus stop signs themselves (Fig. 49).

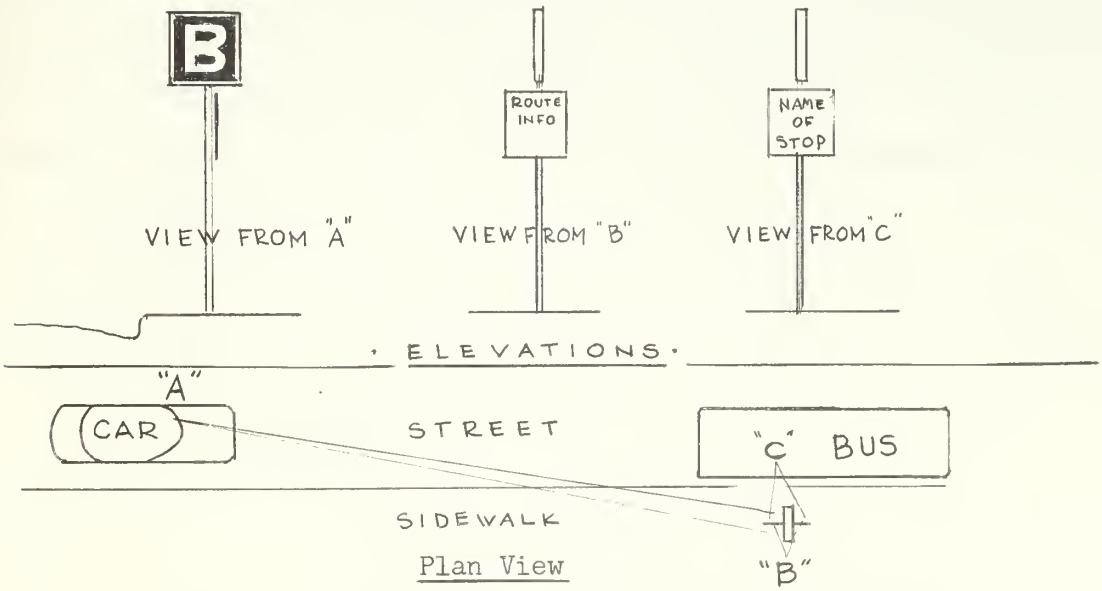

Fig. 49. Minimized Clutter by Right Angle Sign Placement

Most of the changes in sign requirements discussed so far can be incorporated without greatly increasing the existing area of signs on city streets. In fact, as mentioned earlier, individual sizes of some signs might be reduced. Many new bus, train, taxi, and subway signs will merely be replacing outmoded old ones, and the new route signs for bus stops on city streets can be made inconspicuous to the automobile driver by proper placement (Fig. 49). The biggest change will be found inside buildings and stations where there are no landmarks or other guides to orient the traveller to what is outside.

(d) Street Name Signs. Mention was made in Chapter I that the street name sign was the only effective device consistently available to the pedestrian for obtaining information. Although other pedestrian signs are now recommended, they are all located inside buildings and stations. Even after developing all other requirements, there is no change in the singular status of street name signs as the sidewalk guide. It does, however, take on a different character. By the introduction of other guides, the street name sign assumes the role it should have--that of providing continuity of information in a series of maps and signs, rather than being the key to identification in the city. It needs refinement, as shown in Fig. 1, and the support of advance markers as described in Chapter VII; but once it has reached that stage it should remain unchanged.

The system and standards have now been developed. Highway signs have four basic shapes, not including the yield sign, and four basic colors. They are used to the maximum practical extent in all phases of traffic control. Standard identification devices mark the entrances to all forms of transportation, and information posted on city streets is consistently

located where drivers and pedestrians expect to find it. Finally, the traveller is provided with continuous useful information and identification from the beginning of his trip until the end. These are the products of the system. The manner in which they are developed, and will be accepted, is yet another problem.

One thing is certain: In spite of a standard, no two cities will be alike in the solution of individual problems. There will be no ideal model. There are too many variables. Street names, street patterns, the public transportation system,and even tradition will affect design.

The use of color, to aid identification, can be used in an indefinite number of ways without encroaching on the standards proposed. Even nature can provide signs to help the traveller. Distinct tree shapes or species lining main throughfares can act as direction signs at complicated intersections.

But once the system is complete, will it be accepted for use? Can people be made to change, in their minds, the symbols and shapes that have been with them for so long? I think so. First, I do not believe that the meaning of existing traffic signs is so well imbedded in the minds of their users that a new shape or color would cause any great confusion. A study conducted in Sweden[7] in 1953-54 showed that only about fifteen per cent of drivers interviewed recognized the meaning of all sign illustrations presented to them for identification. Although conducted in Europe, the results are, I think, indicative of the knowledge of the average driver,

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[7] Statens Trafiksakerherhestrad, Stockholm. Undersokmingar Utforda Under Taden, 1/7, 1953-31/12, 1954, pp. 1-9. Quoted in R. L. Moore and A. W. Christie, "Research on Traffic Signs," p. 122.

U. S. or foreign. So a new system would not be destroying old values as much as it would be building new and better ones.

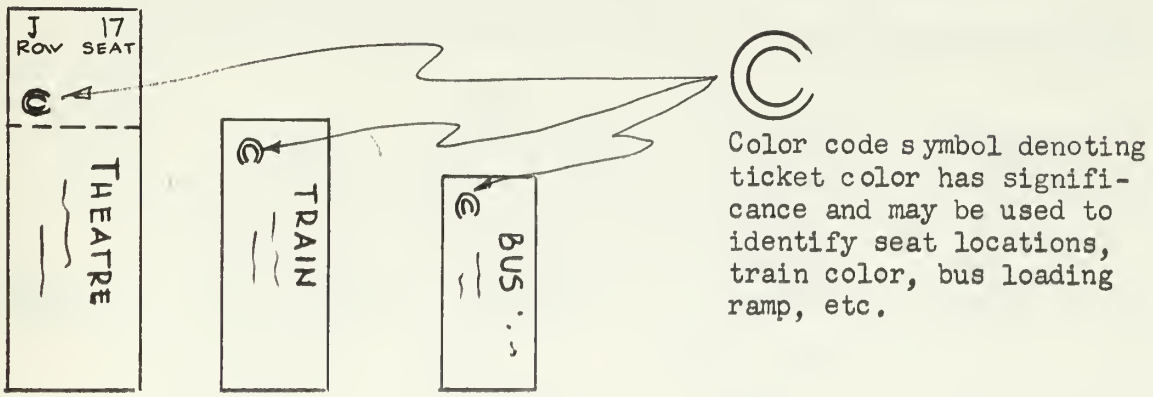

Fig. 50. A Distinctive Symbol to Denote Color Coding.

Second, with proper explanation through good publicity and wider use of traffic signs as recommended, interest in seeing the system work would help establish it. Little things, such as a unique symbol which identified tickets using color coding for direction or location (Fig. 50), would keep the public alert to the benefits which a good standard can provide. The fact that travel could be conducted with a greater degree of confidence would perhaps change the poor opinion many Americans have about even well-kept and comfortable public transportation.

With proper understanding, placement, and design, traffic signs can become a new heraldry.

APPENDIX A

THE CRITERIA OF TRAFFIC CONTROL DEVICES*

No traffic control device will achieve its purpose unless it fulfills these four basic requirements:

These basic requirements are achieved by	Compels attention	Makes its meaning clear at a glance	Permits time for easy response	Commands respect
Design factors	Target values including size, color, and brilliance Movement Sound	Simplicity of legends and messages used Legibility values (pure and glance) Familiarity of legend	Sufficient legibility distance Glance legibility Value	"True and official" respect
Position or placement	Within cone of vision for normal road-user attention, 10-12° in horizontal, 5-8° in vertical	Location with respect to point, lane, or curb to which device applies	Accurately sited with respect to legibility, speed, and travel Distance to point of required response	Logically placed so as to carry its message to road users for whom it is intended
Maintenance of condition and visibility	Maintained in fresh, clean condition, free from sight obstructions	Legends, messages, and legibility kept clean and bright	Maintained to secure high legibility values	Maintained to avoid appearance of being abandoned or forgotten Removed when no longer required
Uniformity of application and use	Good standards to assure highest attention-compelling values	The same device for the same purpose at the same relative position	Standards of design, placement, and use to assure adequate time if adhered to	Standardized official devices, logically used for warranted traffic conditions

*Source: T. M. Matson, W. S. Smith, F. W. Hurd, Traffic Engineering, New York: McGraw-Hill Book Company, Inc., 1955, Table 19.1, p. 309.

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